T.O. 31R2-4-18-3
(Formerly AN 16-45-435)

HANDBOOK
OVERHAUL INSTRUCTIONS

# RADIO RECEIVER

## MODEL SP-600-JX-17

(HAMMARLUND)

PUBLISHED UNDER AUTHORITY OF THE SECRETARY OF THE AIR FORCE
AND THE CHIEF OF THE BUREAU OF AERONAUTICS

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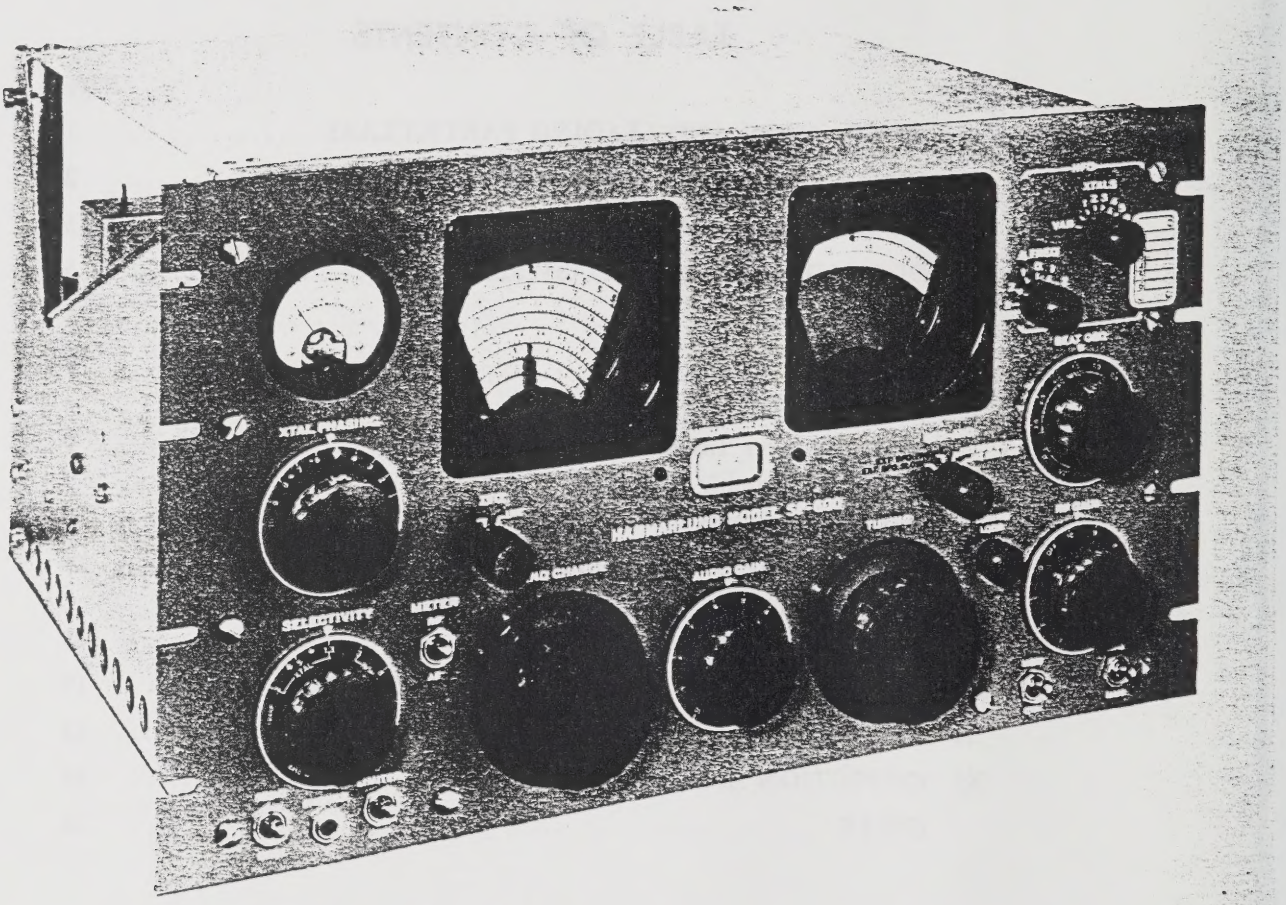



*Figure 1–1. Radio Receiver, Diversity Model SP–600–JX–17 Rack Mountings*

# SECTION 1
# DESCRIPTION AND LEADING PARTICULARS

## 1–1. GENERAL.

1–2. This publication comprises overhaul instructions for the Radio Receiver, Diversity Model SP–600–JX–17 rack mountings (figure 1–1), manufactured by the Hammarlund Mfg. Co. Inc., New York 1, N. Y. It supplements AN 16–45–434, the Handbook of Service Instructions, to afford complete coverage of the receiver.

1–3. The receiver, designed for direct mounting in a standard 19-inch relay rack, is a 20-tube general purpose radio communication receiver with a self-contained stabilized power supply suited to operate from a single phase 50- to 60-cps, 90 to 270 volt a-c source. It provides for the continuously variable selective reception of any radio frequency carrier in the 0.54 to 54.0 mc frequency range and for fixed frequency crystal controlled reception from two to 30.0 mc. The rotary turret which houses the six frequency bands of the receiver, in association with the gear-train drive, provides the precise mechanical stability whereby the excellent electrical characteristics of the receiver are maintained. Also, these mechanical features enable full advantage to be derived from the crystal filter incorporated in the i-f amplifier of the receiver. The receiver functional circuitry is mostly contained in subassemblies, each of which may be removed for repair or replacement. The receiver is designed for fixed and/or mobile operational activities such as are encountered at enclosed base or field stations, aboard ship, or when airborne. Such activities may be subject to wide ranges in temperature and humidity since the receiver is adequately conditioned for tropical use. The receiver is fully shielded to keep its radiation characteristics to a possible minimum.

## 1–4. PERTINENT INFORMATION.

1–5. The radio receiver is suited to operate in single or mult-receiver two-way operational activities. It is especially suited for use in dual-receiver frequency-shift space diversity receiving systems. Any activity requires that certain auxiliary components be associated with the receiver. Apart from the phones jack contained in the front panel and the h-f-o output connector on the frequency control unit, all the receiver inter-connecting means are located on the rear apron. The rear apron also contains two cartridge type fuse holders, one for a 1.6-ampere fuse in series with the power transformer primary winding, and the other for a three-eighths ampere fuse in series with the center tap of the power transformer secondary plate winding. The front panel of the receiver contains all the receiver operating controls. All the receiver adjustment controls are located on the rear apron. The coil adjustable tuning cores and trimmer capacitors used to align the receiver, and the adjustment controls on the rear apron, maintain their alignment and adjustment settings for long periods of time. Through the use of various types of springs, all the receiver adjustable fixed and moving parts are provided with positive positioning and operation. Also, flat springs are used on the rotary turret subassembly to provide for electrical grounding. The receiver r-f coils, r-f chokes, and all soldered connections are fungicidal varnished for tropicalization; also, all metal parts in contact conform to the electrochemical series of elements so that corrosion is kept to a possible minimum. In view of the fact that all possible precautions are taken at the factory to provide each receiver for use in perfect condition, the preventive maintenance and overhaul performed on the receiver should be done with the least possible recourse to the needless unsoldering and replacement of parts.

# SECTION II
# SPECIAL OVERHAUL TOOLS AND TEST EQUIPMENT

## 2–1. SPECIAL TOOLS.

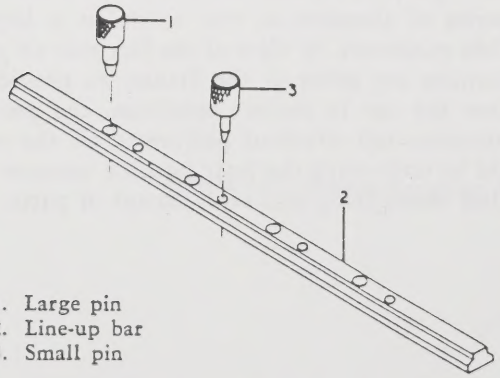
2–2. The special overhaul tools required to perform the work outlined in this publication are listed in table 2–1. The table refers to the figure and index number of the illustration for each tool, the tool number, and the tool name. The application column in the table briefly denotes the receiver subassembly or parts to which the respective tools are applied when the receiver is overhauled. The manner of use and application of each tool is outlined in detail in paragraphs 7–2 and 8–2.

## 2–3. SPECIAL TEST EQUIPMENT.

2–4. No special test equipment is required to align, adjust, or final test the radio receiver. To facilitate the testing of the receiver a test position should be maintained, provided with the appropriate test equipment and fabricated cables, as described in AN 16–45–434, the Handbook of Service Instructions.

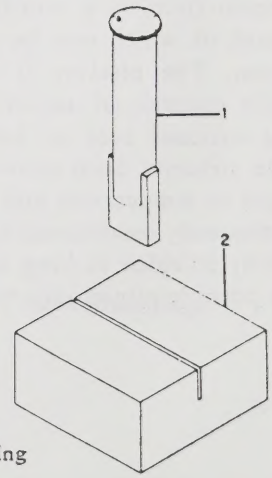
**TABLE 2–1. SPECIAL TOOLS REQUIRED FOR OVERHAUL**

| FIGURE & INDEX NO. | HAMMARLUND TOOL NO. | TOOL NAME | APPLICATION |
|---|---|---|---|
| 2–1, 1 | T7982–5 | Pin, locating | R-F strip subassy. |
| 2–1, 2 | T7982–6 | Bar, line-up | |
| 2–1, 3 | T7982–7 | Pin, locating | |
| 2–2, 1 | T8331–1 | Swage | Contact spring and partitions, tuning unit shield. |
| 2–2, 2 | T8331–2 | Mounting, seat | |
| 2–3, 1 | T7644 | Jig, fixture | Turret rotor subassy. |
| 2–3, 2 | T8332 | Rod | Turret rotor and tuning unit shield, line-up. |
| 2–3, 3 | T8333 | Wrench, spanner | Turret rotor subassy nuts. |
| 2–4, 1 | T8335 | Jig | Band dial location. |
| 2–4, 2 | T8334 | Pliers | "C" washers, crimping. |



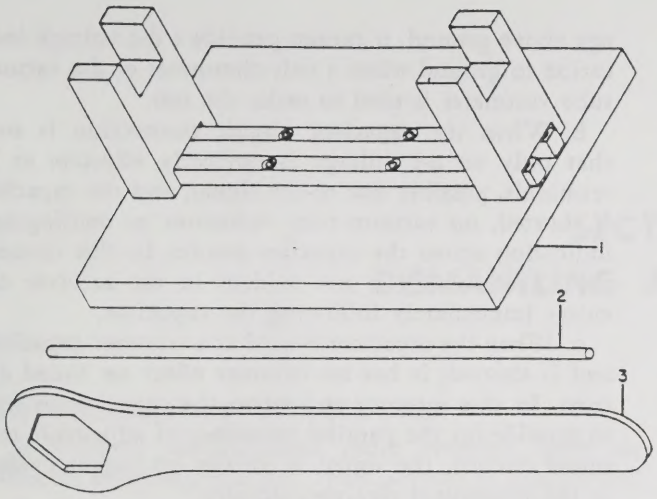

1. Large pin
2. Line-up bar
3. Small pin

*Figure 2–1. Special Tools to Reassemble R-f Strip Assembly*



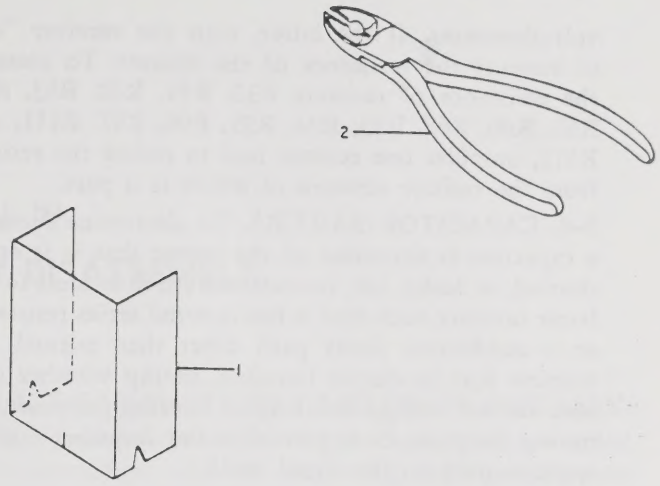

1. Swage
2. Seat mounting

*Figure 2–2. Special Tools to Reassemble Tuning Unit Shield Assembly*




1. Fixture jig 2. Rod 3. Spanner wrench

*Figure 2–3. Special Tools to Reassemble Turret Rotor Assembly*




1. Jig 2. Pliers

*Figure 2–4. Special Tools to Reassemble Gear-train Assembly*

# SECTION III
# SPECIALIZED MAINTENANCE AND REPAIR

## 3–1. GENERAL.

3–2. The specialized maintenance and repair activities within the scope of depot overhaul are based on receiver trouble-shooting procedures supplementary to those provided in AN 16–45–434, the Handbook of Service Instructions. The data is useful in the step-by-step procedures used to determine specific circuit failures.

3–3. Before specialized maintenance and repair activities are resorted to, ascertain whether the receiver fault is due to any one or more of the following causes:

a. Damage or miswiring.

b. Abnormal short circuits between parts or to ground, prior, or subsequent, to the reassembly of the subassembly or part to the receiver.

c. Faulty parts, whose fault is only evident when the part has been allowed to warm up by turning the receiver "on".

3–4. All of the receiver circuitry is accessible, apart from that contained in the r-f strip. When the receiver fault is isolated to the r-f strip, it must in any case be removed from the receiver for repairs or for replacement. To determine the specific cause of the r-f strip failur requires part-by-part analysis to the extent required to isolate the faulty part. The r-f strip removed for repairs may be externally reconnected to the receiver through means of insulated "pee-wee" clip leads, to render accessible its circuitry for purposes of analysis. When doing this do not attempt to reconnect the four-gang variable tuning capacitor unless it too or a spare is external to the receiver. The r-f tuners for the frequency band desired may be seated in the r-f strip steatite base "V" contacts for same.

**WARNING**

Keep the receiver turned "off" when externally reconnecting the r-f strip to the receiver.

## 3–5. SPECIALIZED MAINTENANCE PROCEDURE.

3–6. The specialized maintenance procedure outlined in each of the following categories differs from that outlined in AN 16–45–434, the Handbook of Service Instructions, to the extent that the parts in subassemblies are all analysed to the extent possible with regard to being defective while contained in the receiver which remains turned "on" and allowed a warm-up period of at least five minutes.

3–7. RESISTOR FAILURE. To determine whether a resistor is normal as evidenced by its resistance value in ohms, determine first its circuit function, noting whether it is isolated or whether it has a d-c voltage drop across it. If the former, determine first, utilizing a volt-ohmmeter, that it has no d-c voltage across it, possibly due to the failure of its associated isolating capacitor, and then measure its resistance, utilizing the

volt-ohmmeter. If the latter, turn the receiver "off" to measure the resistance of the resistor. To measure the resistance of resistors R32, R33, R48, R53, R60, R61, R66, R68, R93, R94, R95, R96, R97, R111, and R112, unsolder one resistor lead to isolate the resistor from the resistor network of which it is part.

3–8. CAPACITOR FAILURE. To determine whether a capacitor is abnormal to the extent that it is open, shorted, or leaky, i.e., its construction is at fault in the latter instance such that it has internal series resistance or a conductive shunt path other than normal, determine first its circuit function, noting whether it is used for d-c voltage isolating or filtering purposes, for tuning purposes, or to provide a low impedance series or shunt path for the signal itself.

3–9. OPEN CAPACITOR. An open capacitor cannot provide a low impedance series or shunt path for the signal or be used to tune a circuit to resonance. Also, it cannot provide for filtering action, but will keep a circuit isolated. In the isolating instance the capacitor usually carries the signal or other a-c voltages across it so that an open capacitor can always be analysed with regard to its circuit function. To do this, apply an appropriate signal to the applicable test point such that the capacitor under consideration, if normal, may perform its function, and utilize an a-c vacuum tube voltmeter or a cathode ray oscilloscope indication to determine whether the capacitor is open. Each of the following circuit indications, as applicable, provide for checking an open capacitor.

a. When the capacitor is in series with the signal path of the receiver, but open, its input signal indication is much higher than its output signal indication, to ground in each instance.

b. When the capacitor provides a return path to ground for the signal, but is open, its away-from-ground terminal is at an a-c voltage level above ground.

c. When the capacitor is used to tune a circuit to resonance, but is open, the circuit inductance cannot be adjusted for resonance.

d. When the capacitor is used to provide audio filtering action, but is open, its away-from-ground terminal will provide indication of excessive ripple, as compared to when the open capacitor is shunted by a normal capacitor.

e. When the capacitor is used to provide decoupling action in r-f circuits, but is open, more signal indication may be observed, as compared to when the open decoupling capacitor is shunted by a normal capacitor.

3–10. SHORTED CAPACITOR. The effect a shorted capacitor has on the receiver circuitry is such that the shorted capacitor may be rapidly identified. This is due to the fact that the shorted capacitor cannot have a d-c or a-c voltage drop between its terminals. Each of the following circuit indications, as applicable, provide for checking a shorted capacitor.

a. When the capacitor circuit connection is such that one of its terminals is normally at some d-c voltage above ground, it cannot provide a d-c voltage indication to ground when a volt-ohmmeter or d-c vacuum tube voltmeter is used to make the test.

b. When the capacitor circuit connection is such that only an a-c voltage is normally effective at its terminals, possibly due to the signal, and the capacitor is shorted, no vacuum tube voltmeter or oscillograph indication across the capacitor results. In this instance the signal usually is not evident in the receiver circuitry immediately following the capacitor.

c. When the capacitor is used as a trimmer capacitor, and is shorted, it has no trimmer effect on tuned circuits. In this instance and when the capacitor is used to provide for the parallel resonance of adjustable core tuned circuits, the signal is usually no longer evident in the subsequent receiver circuitry.

d. When the capacitor is shunted by a resistor as is the case in certain of the r-f tuners, and it is suspected that the capacitor is shorted, the shunted resistor, measured for resistance as outlined in paragraph 3–7, will determine whether the capacitor is shorted. If an indication across the capacitor is to determine whether it is shorted or not, be sure to provide enough signal input to the receiver.

3–11. LEAKY CAPACITOR. In the rare instance when a capacitor is suspected of being leaky such that its leakage characteristics are to be determined, avoid having to unsolder one of the capacitor terminals from the receiver by utilizing every possible receiver switch and/or tube means to provide for isolating the capacitor terminal. To determine whether a capacitor is leaky do the following:

a. Turn the receiver to its a-c power "off" position.

b. Adjust the volt-ohmmeter to its highest ohmmeter range and connect it across the capacitor. If the capacitor is good the ohmmeter needle flicks over slightly and gradually drops back to infinity.

c. Now reverse the test prods and note that the ohmmeter needle flicks to twice the deflection it did before, the needle then returning to the position indicating infinite resistance, if the capacitor is good. If the needle does not go back to infinite resistance indication the capacitor is leaky and should be replaced. This test is not reliable for capacitors whose capacitance value is less than 0.05 uf.

**Note**

When the capacitor is an electrolytic capacitor one reading will show low resistance and the other much higher. If the higher resistance is not over 100,000 ohms and comparable to that of a prototype capacitor, the electrolytic capacitor must be replaced.

Make sure to turn the receiver "on" at least 15 minutes before making the test to render assurance that the electrolytic capacitor dielectric film deterioration due to shelf life, if any, may be repaired due to subjecting the capacitor to its d-c working voltage.

# SECTION IV
# DISMANTLING AND DISASSEMBLY

4–1. PRELIMINARY PROCEDURE.

a. Remove the cartoned radio receiver from its wooden shipping box and then unpack it completely.

b. Dismantle the radio receiver top cover and bottom plate from the receiver chassis and panel assembly.

c. Dismantle the seven plug connector assemblies, the electron tube complement, the front panel controls, the frequency control unit switch arm and eccentric drive assembly, the front panel assembly, etc. from the receiver chassis and panel assembly.

d. Strip the receiver chassis and tuning unit assembly with regard to main dial indicator and mounting, both main and vernier dials, both side plates, etc.

4–2. DISMANTLING OF TUNING UNIT ASSEMBLY. To dismantle the tuning unit assembly from the receiver chassis and tuning unit assembly, use the following step procedure:

a. Unsolder two green/white leads, one each from the E14 and E17 terminal strips.

b. Unsolder two blue/black leads from the T2 second mixer transformer.

c. Unsolder white/black, red/white, blue/red, yellow/black, and red/green leads from the E13 terminal strip.

d. Unsolder two red/green, one green/red, and one yellow/red leads of the main wiring cable from the S4 conversion switch.

e. Remove two No. 10–32 screws and one stud post assembly, on either side of tuning unit assembly, which screw into nut plate brackets through clearance holes in gear-train plate and chassis proper.

f. Remove one No. 10–32 screw in angle bracket on rear of tuning unit assembly which passes through clearance hole at back of chassis proper.

g. Lift out the tuning unit assembly.

4–3. The tuning unit assembly comprises several subassemblies which may be dismantled from it and then separately disassembled. These are the following:

a. The mixer plate coil assembly, T1.

b. The r-f wiring assembly, i.e., the r-f strip.

c. The variable capacitor, i.e., the eight section, four-gang tuning capacitor.

d. The gear-train assembly.

e. The 24 r-f subassemblies, i.e., the r-f tuners.

4–4. DISASSEMBLY OF GEAR-TRAIN ASSEMBLY. The gear-train assembly (figure 4–1) is disassembled in accordance with the following step-by-step procedure.

a. Remove cam, hub, and band change dial assembly (1).

b. Remove indicator slide helical spring (2) and conversion switch helical spring (3).

c. Remove conversion switch lever assembly (4).

d. Remove the two band change helical springs (5), and then remove the band change cam detent roller and lever assembly (6).

e. Remove the three No. 10–32 screws (8) used to mount the three mounting posts (7), to which are attached the bearing plate (9) and the bearing plate (10). Doing this provides for the dismantling of the movable support main pointer bracket (15), the shaft, gear, and hub assembly (16), the cam (25) which activates roller and arm assembly, the ball bearings (20), the flywheel (22), the idler wheel (23), and the gear and drive pin assembly (21).

f. Remove the two spur type gear assembly (26) from the spider assembly at the top right side of the base plate assembly (43), and then remove the spur type gear (27), with included stop pin.

g. Remove spur type gear (28) from top left side of the base plate assembly (43) and the main dial hub spur type gear (29) adjacent to it.

h. Remove gear assembly (31), which includes two spur gears mounted on a small brass plate.

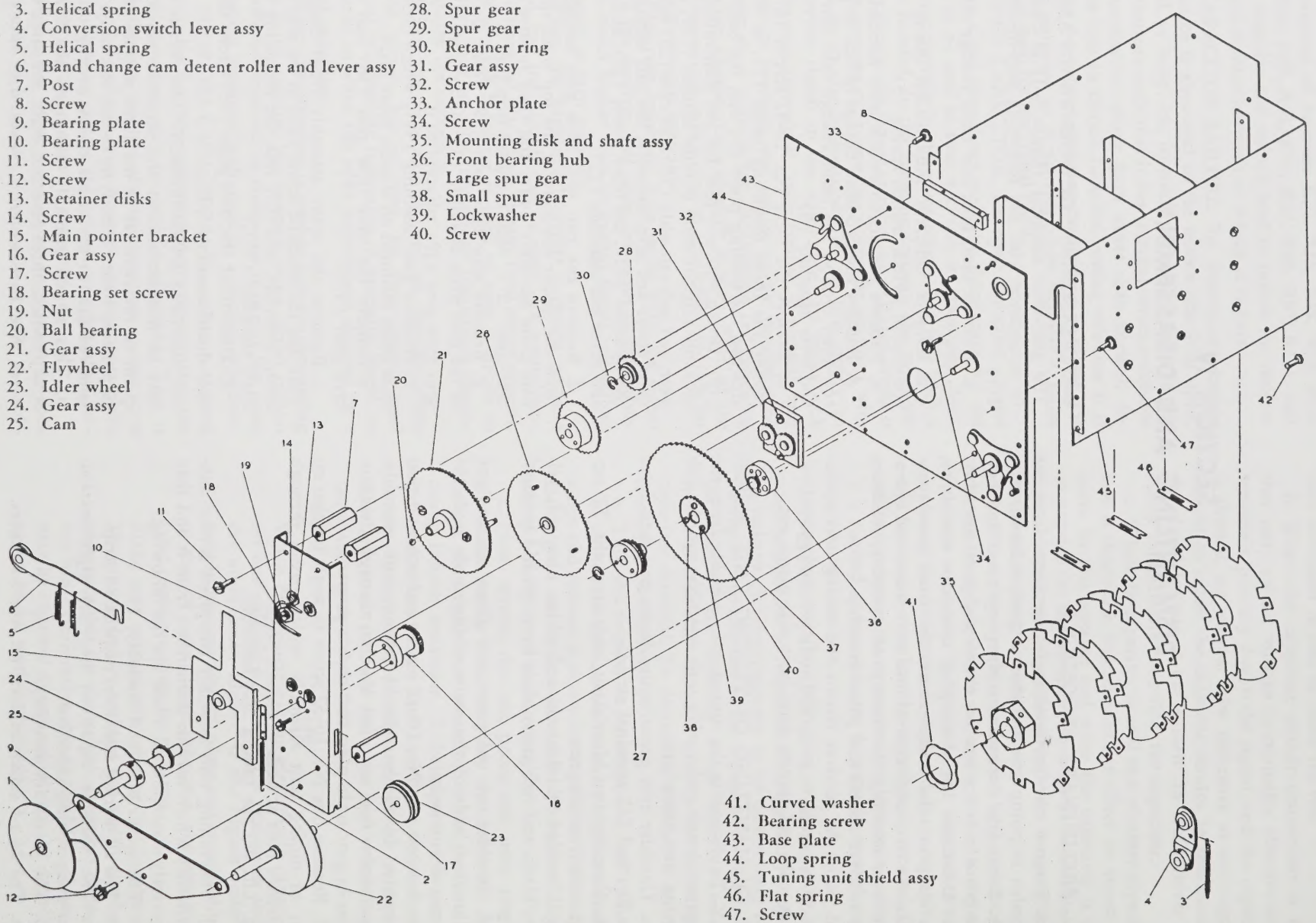
i. Remove the spur type gear (38) and the spur type gear (37).

j. Remove the rotor assembly front bearing hub (36) and the machine screw (42) at the rear from the rotor assembly, and lift out the mounting disc and shaft assembly (35).

k. Disconnect the base plate (43) from the tuning unit shield assembly (45).

4–5. CHASSIS DISASSEMBLY. The chassis assembly may be disassembled in any sequence desired subsequent to the removal of the three section, four pole, 20-position rotary selectivity switch assembly, which is removed first to get at all chassis wiring underneath it. This switch assembly comprises the S5A, B, C, rotary switch, three resistors, eight insulated electrical wires, five bare electrical wires, and two pieces of

1. Cam, hub, and band change dial assy
2. Helical spring
3. Helical spring
4. Conversion switch lever assy
5. Helical spring
6. Band change cam detent roller and lever assy
7. Post
8. Screw
9. Bearing plate
10. Bearing plate
11. Screw
12. Screw
13. Retainer disks
14. Screw
15. Main pointer bracket
16. Gear assy
17. Screw
18. Bearing set screw
19. Nut
20. Ball bearing
21. Gear assy
22. Flywheel
23. Idler wheel
24. Gear assy
25. Cam
26. Two spur gear assy
27. Spur gear
28. Spur gear
29. Spur gear
30. Retainer ring
31. Gear assy
32. Screw
33. Anchor plate
34. Screw
35. Mounting disk and shaft assy
36. Front bearing hub
37. Large spur gear
38. Small spur gear
39. Lockwasher
40. Screw



41. Curved washer
42. Bearing screw
43. Base plate
44. Loop spring
45. Tuning unit shield assy
46. Flat spring
47. Screw

*Figure 4–1. Gear-train Assembly, Exploded View*

vinylite tubing which cover in part two of the bare electrical wires. The switch assembly is removed in preference to removing the rotary switch proper to facilitate the unsoldering necessary during removal.

4–6. Certain other subassemblies and parts of the chassis assembly, likewise, are unsoldered in a manner to facilitate the unsoldering necessary during removal. These are:

a. The audio output transformer which is removed with all the electrical wire leads and one capacitor that are soldered to it.

b. The antenna input socket which is removed with the black electrical wire that is soldered to it.

c. The meter a-f adjustment potentiometer and the bfo-avc switch are removed with the electrical wire jumpers that are soldered to them.

d. Both the large octal sockets which are removed with the electrical wire leads, resistors, and capacitors that are soldered to them.

4–7. The r-f strip, i.e., the r-f wiring assembly, which is contained in the tuning unit assembly, has its tube sockets removed with the bare electrical wires that are soldered to certain of the tube sockets. Also, the isolantite switch bases of the r-f strip are removed with the bare electrical wires, certain resistors, and certain capacitors soldered to them, which do not interfere with the removal.

4–8. The frequency control unit and the audio filter assembly, which are contained in the chassis and panel assembly of the receiver, may be dismantled from the receiver at any stage in the overall disassembly procedure outlined. The frequency control unit socket and selector switch are disassembled by unsoldering the bare electrical wire leads soldered to them away from the socket and switch contact terminals; also, the bare electrical wire common to the six crystal sockets is unsoldered subsequent to the removal of the crystal socket plate carrying the crystal sockets. The audio filter assembly is disassembled subsequent to its dismantling as a unit.

# SECTION V
# CLEANING

## 5–1. OVERALL.

5–2. The radio receiver may be blown out with compressed dry filtered air at a pressure of approximately 100 lb/sq in. Accessible parts may be wiped with a clean cloth. Not too readily accessible parts may be dusted with a small dry brush.

## 5–3. ELECTRICAL PARTS.

5–4. When the radio receiver is dismantled and its subassemblies are disassembled, all wired electrical parts may be blown out, wiped, and dusted as outlined in paragraph 5–2 for the overall receiver. The air pressure at the subassembly or part may be decreased by increasing the distance between the air nozzle and the work.

**WARNING**

Wear goggles to protect eyes from dust.

## 5–5. MECHANICAL PARTS.

5–6. All mechanical parts such as the chassis, side plates, shields, screws, etc., may be cleaned by brushing with Federal Specification VV–K–211b Kerosene or Federal Specification O–C–141 Carbon-Tetrachloride. To remove corrosion use No. 000 sandpaper as well, then wipe with a clean cloth.

5–7. Dirty gears are cleaned best with a pipe cleaner or small brush dipped in any one of the cleaning fluids mentioned in paragraph 5–6. The variable air trimmer capacitors may be cleaned by soaking them bodily in any one of the cleaning fluids identified in paragraph 5–6, and then blowing them out. This applies to the r-f trimmer capacitors even when assembled to their isolantite bases, with r-f coils, resistors, and all other fixed capacitors removed.

## 5–8. PRESERVATION AFTER CLEANING.

5–9. R-F COILS AND CHOKES. The r-f coils and chokes used in the radio receiver are all treated by dipping in bakelite resin, fungicidal varnish approved as per JAN Specification JAN–C–173. The approved thinner used with this varnish is as per Federal Specification PTX–916 Grade B.

5–10. FOUR-GANG VARIABLE AIR CAPACITOR. The four-gang variable air capacitor end bearings are lubricated at the factory with Air Force-Navy Aeronautical Specification AN–G–15a Grease. It may be lubricated in the remote instance when the need arises.

5–11. AIR TRIMMER CAPACITORS. The variable air trimmer capacitors are all lubricated at the factory with Air Force-Navy Aeronautical Specification AN–G–15a Grease.

**Note**

Do not lubricate the variable air trimmer capacitors even though cleaned as outlined in paragraph 5–7.

5–12. GEAR-TRAIN ASSEMBLY. The reassembly of the radio receiver gear-train assembly, outlined in paragraph 8–2, subsequent to overhaul, requires that the Military Specification MIL–G–3278 Grease, used at the factory for lubrication purposes, be replaced. The MIL–G–3278 Grease is applied to the front bearing hub (36, figure 4–1), to the rear bearing machine screw (42), and to the two ball bearings (20); also, at the bearings of the five tempered shafts on the base plate assembly (43), at those of the shaft of the flywheel (22), at those of the gear assembly (16), and at those of the shaft of the gear assembly (24).

# SECTION VI
# INSPECTION

## 6–1. GENERAL.

6–2. The radio receiver is inspected, by careful observation and feel, with regard to any possible physical indication other than normal. Even though the receiver mechanical defect appears trivial, it must be repaired at the first opportunity presented so that it does not tend to develop cumulative receiver abnormalities leading to serious failure. As such, inspection is closely concerned with preventive maintenance whereby periodic receiver overhaul provides for qualified inspection personnel to determine the need for the immediate repair of the receiver; or, to decide that the nature of the receiver abnormality is insignificant enough to be taken care of at a later overhaul date.

6–3. INSPECTION TECHNIQUE. To provide for the proper inspection of each radio receiver, the inspector must thoroughly familiarize himself with the receiver with regard to each of the following considerations.

a. Determine first the normal appearance of the radio receiver by carefully noting the appearance of each subassembly and part and their assembled interrelationship as outlined in paragraphs 4–1 thru 4–8 and 8–1 thru 8–3. Until such time that the normal detailed appearance of the receiver is committed to memory, compare the receiver part by part with a receiver known to be in the condition in which it left the factory. Carefully observe the color and finish of all parts, their relative placement, the dressing of each electrical wire, the quality of the crimping of each soldered wire, the amount of solder used to make a soldered joint, and the manner and location of those soldered joints providing for electrical ground. Note that all soldered joints, all r-f coil assemblies, and all r-f chokes are tropicalized as evidenced by their brownish fungicidal varnish coating. Note that the eight nuts at the two escutcheons on the front panel, the 12 nuts at the six crystal sockets on the frequency control unit, the bearing set screw (18, figure 4–1), and each nut used to mount each pin on each of the 24 r-f tuner subassemblies is coated with U. S. Army Specification 3–182 Clear Varnish. The varnish is used as an aid to secure each nut in each instance since not too much strain can be used to tighten each assembly.

b. Determine next the manner in which the receiver operating controls activate the mechanical means used to perform each control function. Get the feel of each control and commit it to memory. Note that the tuning control is flywheel balanced and that it is free to turn even when the tuning lock is locked. Note that the two indicators for the main dial and the one indicator for the vernier dial all simultaneously indicate zero dial indications when the four-gang variable air capacitor is fully meshed. Note that the movable main dial frequency indicator pointer locates at the frequency scale on the main dial corresponding to the frequency band indented and whose frequency range is that shown on the dial visible through the small window contained in the front panel. Note the manner in which the frequency control unit crystal switch arm and eccentric drive assembly drives the two switches coupled to the drive assembly, the orientation of the drive arm and the effect of the small helical spring used. Note the spring-return action of the meter switch. Note the extent to which the gears on the gear assembly (31, figure 4–1) mesh with those they engage and the hole provision in the bearing plate (9) to get at one of the screws (32). Note that the lubrication used on the gear-train assembly is barely visible. Note by feel the tightness of the adjustable tuning cores and trimmer capacitors, but make sure not to disturb their adjustment settings.

6–4. RECEIVER ABNORMALITIES. Inspect the receiver with regard to each of the following possible categories of abnormality:

a. AGING. The aging of the receiver is indicated by the sloppy or non-positive operation of movable parts whose normal function during movement or

when indented is controlled through the use of springs, cams, gears, ball bearings, or precise bearing fits to trued machined shafting.

b. BURNING. The overheating of the receiver is indicated when parts comprising it show discoloration, blistering, bulging, or smell burnt.

c. LEAKAGE. The evidence of oil or insulating compound at the terminals of sealed container parts provide the earliest possible evidence of receiver leakage. The leakage may be evident too at pin holes and/or breaks in the container enclosed part itself.

d. CORROSION. The evidence of receiver corrosion is the oxidation (rust) which forms on surfaces, screws, nuts, etc., usually where different metal areas are in contact.

e. DUST, DIRT, ETC. The need for cleaning the receiver is evaluated best by the extent to which dust, dirt, etc. has accumulated at electron tube socket terminals, resistor boards, and other not too easily accessible soldered joints and corners in the receiver.

f. LOOSENESS. The need for tightening any subassembly or part comprising the receiver is evaluated by feeling the suspected loose part for tightness. In the instance of attaching hardware such as nuts and/or screws, consider the assembly tight when no more than a 90 degree turn may be taken up in the attaching part. Make sure to reseal those nuts listed above in paragraph 6–3 whenever occasion arises to tighten any one of them.

## 6–5. RECEIVER INSPECTION.

6–6. Apart from the careful inspection of the radio receiver for physical damage evident by observation, the receiver controls should all be tried to render assurance that they function properly. Dependent on the inspection appraisal of the receiver on receipt for overhaul, a decision should be made as to whether or not the receiver should be turned "on" to determine the electrical condition of certain of its functioning parts, before dismantling and disassembly. Whenever the receiver is turned "on" for inspection, it should be stripped so that the receiver chassis and panel assembly may be under observation. Then inspect the receiver for the following conditions:

a. Check the r-f gain and the audio gain controls for noisy operation; if so, replace them.

b. Switch the selectivity switch from position to position and note if the receiver fault is such as to cause arcing at any one of the switch contacts. This is a very remote possibility but in any case each switch contact should be inspected for evidence of charring of the bakelite switch wafers; if any, replace the switch.

c. Check at all tube sockets terminals for possible arcing and charring between terminals; if any, replace the tube socket concerned. To look at the tube sockets on the r-f strip, remove the r-f coil assemblies, and use a small dental mirror.

d. Check the conversion switch contacts for arcing and evidence of charring between contacts; if any, replace the switch.

6–7. SWITCH BASE AND SPRING ASSEMBLY. With the receiver turned "off," remove the 20 r-f tuner subassemblies on five of the six receiver frequency bands, doing this with the receiver chassis and panel assembly turned upside down. Engage the pin contacts of the four r-f tuner subassemblies kept in the tuning unit assembly with the "V" switch contacts assembled to the isolantite bases contained in the r-f strip, using the band change control on the front panel. Note to see that the "V" switch contacts are spread by the pin contacts and that the pin contacts center up in the "V" switch contacts; also check to see that none of the "V" switch contacts are broken, or that the pin contacts in any one of the 24 r-f tuner subassemblies are loose. Replace any broken "V" switch contacts and tighten any loose pin contacts, if any, as outlined in paragraph 7–2a.

## 6–8. SUBASSEMBLY INSPECTION.

6–9. For purposes of receiver overhaul, each subassembly removed from the receiver may be inspected with regard to each of the following considerations, as applicable.

a. Check the dressing of each part, such as capacitors, resistors, coils, chokes, terminal boards, and the electrical wire lead lengths used. Check the clearance between parts and their mountings, the encoded values and tolerances with regard to resistors and capacitors; also check the part numbers of coils, r-f tuner subassemblies, and the reference symbol circuit designations on transformer shield assemblies, etc.

b. Check the quality of each soldered joint and the location and manner of making each specific subassembly ground connection.

c. Check the tightness of staked terminals, screws, nuts, clamps, and all parts comprising the subassembly. Check each spring for resilience and proper length, curvature, etc. Check adjustable tuning cores for proper operation and, if bent, note the extent to which the tuning core in each instance enters the coil it tunes, so that it may be so readjusted prior to reassembly, thereby not necessitating too much of an adjustment during the subsequent alignment.

d. Shake out from the subassembly loose metal and other particles. Make sure none remain wedged in the assembly. Also look closely for metal or other whiskers, if any, especially as between the stator and rotor plates of the variable air trimmer capacitors. Mesh all trimmer capacitors, checking for even meshing and spacing between plates.

e. Carefully check bakelite and melamine boards for scratches and cracks; make sure isolantite bases, insulator feed throughs, and crystal porcelain holders are not minutely cracked or chipped.

f. Check multiple coil assemblies mounted on the same form for spacing. Make sure the start and finish leads on all coil assemblies are properly connected. Check each coil for continuity and for broken strands (one broken strand is permissible). Check for nicks or scratches on coils and chokes, also check to see that the fungicidal varnish coating provided is not punctured.

g. Check the possibility of the parts of the subassembly shorting to other subassemblies or to the receiver chassis, when assembled. Make sure the pilot lamps, meter board, etc. mount rigidly.

h. Check to see that the metal finish on each of the plated parts contained in the subassembly has the proper finish. Check to see than any excessive fraying of the insulation of electrical wires is cut off and touched up with U. S. Army Specification 3–182 Clear Varnish.

## 6–10. PARTS INSPECTION.

6–11. For purposes of receiver overhaul, each part contained in the receiver, when removed, may be inspected with regard to the considerations outlined for it in one of the following classifications. When a part fails to meet any one of the considerations listed for it, reject it; but in instances where the part only requires cleaning have it cleaned prior to reinspection. All repaired parts must be reinspected prior to use.

6–12. ELECTRON TUBE INSPECTION.

**WARNING**

Allow tube envelopes to cool off before handling to avoid severe burns, unless hands are protected.

To inspect each of the electron tubes comprising the 20-tube complement of the receiver, remove the tube shield, if any, and in the instance of two of the tubes remove the top hat type of tube retainer associated with each.

a. Check the firmness of each tube in its socket. Press the tube into the socket, exerting none other than normal pressure. When the tube is properly seated it should be held firmly in place, as evidenced by feel.

b. Let the tubes cool off before removing them from their sockets in the receiver. Use the appropriate tube remover to remove miniature tubes; also, straighten the miniature tube pins in the appropriate pin straightener before trying to insert the miniature tube into its socket. When inserting the miniature tube do so with the top of the tube socket visible so that the tube pins may be properly aligned in relation to the socket.

c. Inspect the glass envelope of each tube for dirt or corrosion, as applicable; also check to see that the tube envelope is not loose. Make sure that miniature tube pins are not loose or broken, being careful not to bend the pins during removal or insertion of the miniature tube. Check to see that the glass envelope is not chipped at the pins.

6–13. RESISTOR INSPECTION. Apart from the vitreous-enameled bleeder resistors R85, R72, and R73 in the B+ rectifier supply, which are of the usual lug type and rated respectively at 12, 20, and 20 watts, all the resistors in the receiver are of the pigtail, fixed composition insulated type, rated at 1/2, 1/3, or one watt.

a. Inspect the coatings of R85, R72, and R73 for signs of cracking and chipping, especially at the ends of each.

b. Examine the body of each resistor for blistering, discoloration, and breaks, due to possible overheating.

c. Inspect all resistor leads for dirt, dust, corrosion, and looseness. Check the security of all mountings. Once a resistor of the pigtail type is unsoldered, do not re-use in instances where leads were initially cut short since the point of entry of the lead may be partially or completely broken, apart from the fact that resoldering may damage the resistor.

6–14. CAPACITOR INSPECTION. The radio receiver capacitor complement comprises various capacitor types. The four-gang eight section main tuning capacitor, the 24 r-f tuner subassembly trimmer capacitors, the delta frequency control capacitor, and the crystal phasing capacitor are all of the variable air type. For purposes of inspection, the temperature compensating, the silver mica molded, the paper molded, and the oil filled paper tubular capacitors are all classified as of the pigtail lead type, while the hermetically sealed, dry electrolytic tubular and bathtub, and paper bathtub capacitors are classified as of the terminal type.

6–15. VARIABLE AIR TYPE.

a. Inspect the capacitor for dust, dirt, lint, and poor or broken soldering.

b. Inspect the capacitor plates for visible damage such as nicks and bending; also, by meshing the rotor and stator plates, making sure that during meshing the plates do not touch and that they remain reasonably centered at all times with regard to plate spacing.

**CAUTION**

Never tamper with the plates of the main tuning-gang capacitor.

c. Inspect the capacitor plate mountings, terminals, and overall with regard to looseness, wear, breaks, or other damage, making sure that the main capacitor ball bearings and the trimmer capacitor rotor spring assembly in each instance provide for smooth firm rotor and stator meshing.

6–16. PIGTAIL LEAD TYPE.

a. Inspect each pigtail lead type capacitor for lead looseness. Do this by applying a firm steady pull to each capacitor lead in turn, making sure that the tension applied is not excessive.

b. Inspect each capacitor for discoloration, breaks, chipping, and evidence that the capacitor molded encasing does not completely enclose the capacitor assembly.

c. Inspect the three oil filled tubular metal case capacitors (C137, C144, and C163) for evidence of oil leakage at the pigtail lead solder terminal connections, for the quality of the solder terminals, and for corrosion.

6–17. TERMINAL TYPE.

a. Inspect the capacitor terminals for insulation cracks, looseness, corrosion, and evidence of leakage of electrolyte with regard to the dry electrolytic capacitors which may arise when the unit overheats.

b. Inspect the metal case container of each unit for bulges, dents, cracks, and other damage of any kind. Make sure the terminal lugs on the three-section electrolytic capacitor (C161A, B, C) are not loose.

6–18. FUSE INSPECTION. The fuse complement of the radio receiver comprises two holder type fuses, of which one is of the slow blow FUSETRON type rated at 1.6 amperes and the other is of the instantaneous type rated at three-eighths of an ampere. Throw blown fuses away.

a. Inspect each fuse for loose ends and cracks or breaks in their glass encasings.

b. Inspect each fuse holder and holder cap for evidence of burning, charring, corrosion, and dirt; make sure the spring tension in the fuse holder is strong enough to butt the fuse up against the back of the fuse cap, noting that the cap spring tension only provides for holding the fuse to the cap for insertion or removal.

6–19. INSULATOR INSPECTION. The two insulators used in the radio receiver are of the feed-thru type. That on the frequency control unit is made of steatite and has a white glazed finish while that on the r-f strip is made of white isolantite.

a. Inspect the steatite and isolantite insulators for the possible deposit of foreign matter since an insulator is only as good as the condition of its surface.

b. Inspect the steatite and isolantite insulators for fine-line surface cracks where moisture and dust will accumulate and form a leakage path. Make sure these insulators are clean, without cracks, or chipped in any way and that the quality of the soldering and spinning used for mounting is good.

6–20. SWITCH INSPECTION. The switch complement of the radio receiver comprises 13 switches of which seven are of the enclosed type and six are of the open type.

a. Inspect the mechanical action of each switch and look for dirt, dust, and corrosion on all exposed parts. In the instance of enclosed switches check the switch action of the switch by flipping the control knob or toggle; in the instance of the spring return meter switch, note the amount of pressure needed to overcome the spring tension; in the instance of the crystal selector switch make sure the detent action is positive acting and that the front panel control knob activates the frequency control switch contained in the frequency control unit in each of its eight positions but only activates the switch S3 on the base plate (43, figure 4–1), in its two most counter-clockwise positions.

b. Inspect the switch base and spring assembly covered in paragraph 6–7, and the three section selectivity switch contacts for looseness, dust, dirt, and corrosion, making sure that the rotors of each switch make contact with the stators as evidenced by the visible spreading of the stators when engaged by the rotors. Do not pry the leaves of the stator contacts apart in any manner whatsoever, other than by the engagement of the switch rotors themselves.

6–21. R-F COIL AND CHOKE INSPECTION. Apart from the r-f coil or transformer contained in each of the 24 r-f tuner subassemblies, the radio receiver has an i-f, a b-f-o, and a h-f-o output r-f autotransformer, eleven r-f chokes, and 15 r-f transformers or coils, the latter contained in the various transformer subassemblies comprising the receiver. Four of the latter contained in the first and second i-f transformers, are each further contained in two iron cups for purposes of shielding. No attempt should be made to remove said iron cups; the coil assembly itself is to be replaced whenever the need for the replacement of these r-f coils arises.

a. Inspect each r-f coil, r-f choke, and shielded r-f coil for cleanliness, the quality of soldering, the firmness of the terminals and the assembly, fungicidal varnishing, no loose coil turns, as applicable. Make sure that there are no nicks or cracks in the coil forms or in the fungicidal varnish coatings provided each coil. Remember that the coil form functions as a high-voltage insulator whose requirement is the utmost in cleanliness.

b. Inspect each r-f coil and r-f choke for the continuity of each winding. Check the d-c resistance of each winding as tabulated in table 6–5 of AN 16–45–434, the Handbook of Service Instructions, remembering to make allowance for one broken strand in the instance of r-f coils wound with litz wire. Note that the secondaries of the three r-f coils in the r-f tuner subassemblies used on the 1.35–3.45 mc frequency band of the receiver and the four iron cup shielded i-f coils each use No. 15/44 litz wire. In all other applicable instances No. 7/41 litz wire is used.

6–22. POTENTIOMETERS. The radio receiver utilizes potentiometers as r-f gain, audio gain, a-f meter adjustment and r-f meter adjustment controls.

a. Inspect the metallic parts of each control for dust, dirt and evidence of corrosion. Make sure that the unit has no mechanical defects such as loose terminal lugs, loose body assembly, and a loosely keyed shaft.

b. Inspect the insulated body of the unit for cracks, and chipping.

c. Inspect the operation of the control, making sure that the shaft turns smoothly but firmly in its mounting.

6–23. TERMINAL BOARDS. The radio receiver utilizes 19 terminal boards for purposes of part mounting.

a. Inspect the mechanical assembly of each terminal board with regard to loose brackets, terminals, eyelets, rivets, etc.

b. Inspect the terminal board bakelite or melamine insulation for cracks, breaks, dirt, possible charring, or possible breakdown of the insulation due to the corrosion of the metal parts of the terminal board assembly.

6–24. CORDS AND CABLES. The main wiring cable and four shielded insulated lead cables comprise the cord and cable complement of the receiver. The main wiring cable is pre-fabricated before assembly to the receiver chassis and comprises, apart from numerous electric wires, five shielded insulated lead cables.

a. Inspect the insulation of each visible electrical wire and cable contained in the main wiring cable, and that of the shielded lead cables, noting whether the insulation is cracked, deteriorated, cut, kinked due to improper support, or strained due to improper placement.

b. Inspect the cable at each end of each lead for broken strands, fraying of the insulation, and damage due to poor soldering and crimping. A few broken strands are not serious, but make sure that many partially or completely broken strands are not hidden by the insulation.

c. Inspect to see that the braided shield of all the shielded insulated lead cables does not short to the cable lead wires.

6–25. CONNECTORS, PLUGS, AND SOCKETS. The antenna input, the i-f, the h-f-o, the i-f-o, and the b-f-o output connectors, the remote and the a-c power connectors, the phones jack, the six crystal and 20 electron tube sockets comprise the connector and socket complement of the receiver. Further, the seven former have a plug connector associated with each.

a. Inspect the insulation of each for dirt, dust, corrosion, charring, and cracks.

b. Inspect contacts for collected dust, corrosion, breaks, and other than normal looseness.

c. Inspect each connector and socket with regard to the contact provided when its complementary plug, crystal, or tube is inserted. Increase, when needed, the spring tension of the phones jack. When a tube socket has replaceable contacts and requires replacement, this may prove more practical than replacing the tube socket.

d. Inspect a-c power and remote cable clamps for breaks and cleanliness and make sure each has its rubber washer, two screws, and two lock washers.

6–26. METER. The tuning meter contained on the front panel of the receiver has a 100 ma d-c movement and is provided with two scales.

a. Inspect the meter for cracked or broken cover glass, dents in the case, a warped dial, and a bent or broken pointer.

b. Inspect the meter for dust, dirt, and corrosion on the meter case and terminals. Remove the meter cover and repeat the inspection for the inside of the meter cover and the meter proper.

c. Inspect, by checking the meter adjustment screw, to see that the pointer may be properly set to the initial dial indication from either direction. Make sure that the adjustment spring is not caught on the adjustment arm.

d. Test the meter for balance by incorporating it in a circuit such that it will indicate +20 db on the r-f scale at 100 ua plus or minus five percent, and will repeat this test.

6–27. CRYSTALS. The 3.5 mc oscillator crystal and the 455 kc i-f filter crystal, apart from any specially ordered crystals used for fixed frequency crystal controlled operation, comprise the crystal complement of the receiver.

a. Inspect each crystal for dust, dirt, cracks, breaks, and corrosion.

b. Inspect the 455 kc crystal terminals, to which are soldered pigtail type leads, and the 3.5 mc oscillator crystal flat strip terminals, to make sure that they are tight, also inspecting the quality of the pigtail lead soldering in the instance of the former and the terminal silver plating of both. Make sure that the cover spring retainer for the 3.5 mc oscillator crystal provides sufficient tension to firmly seat itself.

c. Inspect the separately ordered crystals for dust, dirt, dents, poor soldering of metal case, corrosion of case and pin terminals, cracked terminal pin insulation, and loose terminal pins. These crystals are ordered according to Military Specification MIL–C–3098, are of the Type CR–18/U, but have metal stamped on the top and one face side the signal frequency in kc for which they are intended.

6–28. TRANSFORMERS AND CHOKES. The receiver audio output and power transformers and the two B+ rectifier filter chokes are all of similar container construction. The power transformer is oil impregnated and hermetically sealed. The audio transformer is oil filled. The two filter chokes are hermetically sealed.

a. Inspect for blistering, bulging, or leakage from containers and from terminals.

b. Inspect for broken, cracked, or charred insulation at the terminals. Inspect to make sure terminals are not loose.

c. Inspect for dust, dirt, lint, or foreign material between terminals since same will absorb moisture which in time provides a leakage path for high voltage breakdown between terminals.

6–29. FUNCTIONAL MECHANICAL PARTS. The mechanical parts such as coupling shafts, couplings, drive arm and eccentrics, gears, lever and roller, dials,

cams, control knob and dial assemblies, springs, etc., which provide for the proper mechanical functioning of the receiver, all require inspection.

a. Inspect for dust, dirt, and corrosion.

b. Inspect for damage, such as cracks, distortion, poor etching, etc., as applicable.

6–30. MECHANICAL PERFORMANCE STANDARDS. The mechanical performance standards of the radio receiver when subjected to normal use are most easily evaluated in terms of the minimum (electrical) performance standards of the receiver; normal use implying that the receiver is not subjected to extreme vibration, extremes in temperature and/or humidity, or exposed to dust, dirt, etc. When the receiver is subjected to abnormal use, or is dropped, an evaluation of the abnormalities or damage sustained determine the extent to which the receiver, certain of its subassemblies, or parts require overhaul.

6–31. LIFE OF THE RECEIVER. The life of the receiver is directly dependent on the preventive maintenance performed with regard to maintaining the receiver in its normal mechanical and electrical state. The replacement of functional mechanical and/or electrical parts, subassemblies, etc., will not impair the subsequent life of the receiver.

6–32. SERVICE LIMITS. The normal mechanical requirements of the receiver provide for no allowable service limits with regard to the mechanical functioning of the receiver parts and subassemblies comprising it. The improper mechanical functioning of the receiver, after long periods of normal use, may be directly attributable to any one or more of the following conditions.

a. Due to accumulations of dust, dirt, sediment, moisture and the resultant corrosion, rotting, etc., the mechanical functioning parts of the receiver may become clogged and subsequently worn so that they no longer function normally.

b. Due to repeated use and mechanical fatigue, the attaching hardware used to assemble the parts and subassemblies to the receiver may loosen up somewhat such that the receiver mechanical functioning becomes impaired, further use possibly resulting in damage to functioning parts.

c. Due to repeated use and mechanical fatigue, the numerous springs used in the receiver may no longer provide the necessary tension required for the normal functioning of the receiver.

d. Due to the repeated use under conditions tending to extremes with regard to vibration, temperature, and humidity, the tendency to other than the normal mechanical functioning of the receiver may be accelerated.

6–33. Whenever the receiver is subjected to overhaul not directly due to the abnormal use of the receiver, the overhaul of the receiver should provide for each of the following checks to be made with regard to the spring complement of the receiver.

a. Check to see that each of the three contact springs used on the partitions in the tuning unit shield assembly are not loose and make positive contact with the turret rotor assembly.

b. Check to see that the wavy washer at the front end of the turret rotor assembly is not loose such that it fails to turns when the turret rotor assembly is indented from one band to the next. A loose wavy washer indicates turret rotor endplay.

c. Check to see that the "U" shaped contact spring at the rear of the turret rotor assembly provides firm wiping contact with the turret rotor assembly and that it is not loosely mounted.

d. Check to see that the receiver helical spring complement, namely that at the pointer slide, the two at the lever and roller detent assembly, and that at the conversion switch, have not lost their tension, doing this by removing each in turn and noting that its unloaded length is normal, i.e., the same as its unused counterpart.

e. Check to see that the three spider springs at the gear-train assembly are not distorted in any way from their normal unmounted shape by comparing them with their normal unused counterpart.

f. Check to see that the 24 r-f tuner subassemblies, the 24 r-f coils mounted on them, the six separately ordered crystals, all adjustable turning cores, and all trimmer capacitors, are all provided with sufficient mounting tension from their respective mounting springs as evidenced by feel for possible looseness.

g. Check to see that the "V" contact springs on the band change switch base and spring assembly are not broken and that they provide contact with the switch pins on each of the r-f tuner subassemblies.

# SECTION VII
# REPAIR AND REPLACEMENT

7–1. GENERAL. The radio receiver comprises parts of which none should be subjected to repair. However, all parts comprising the receiver may be replaced. Of these the replacement of each of the four base and spring assemblies, comprising parts contained on the r-f strip, requires further consideration.

7–2. SWITCH BASE AND SPRING ASSEMBLY. To replace any one of the four base and spring assemblies comprising the stator of the band change switch, first remove the r-f strip from the receiver. The reason for the replacement may be that any one of the six "V" contact springs on each of the four isolantite bases or the bases themselves, may be broken.

a. To replace a "V" contact spring, the defective spring is removed by first removing the solder from the spring terminals which holds the spring in place in the isolantite base. Then spring back the spring ear on each spring leg in turn while pushing in a direction to remove the spring. Note the spring ear locations on the spring to be replaced. A new spring is then substituted for the defective spring removed, solder being used to retain it in place in a manner evident from any of those contained in any one of the isolantite bases.

b. To replace a base and spring assembly use is made of the line-up bar (2, figure 2–1) and pins (1, 3), to properly locate the base and spring assembly with regard to its inter-relation to the rest of the r-f strip assembly. The terminals of the isolantite base to be replaced are all cleared first by unsoldering the parts and leads soldered between them and the r-f strip proper. The isolantite base itself is then unsoldered by removing the solder from the two eyelets it contains, and through means of which it is mounted to the r-f strip. The isolantite base is then removed so that a new one may be used to replace it. To properly locate the new isolantite base, the line-up bar (2) is located over it and the other isolantite bases contained in the r-f strip. The line-up bar (2) is then located in relation to the isolantite bases soldered to the r-f strip through means of the pins (1, 3) which fit thru the line-up bar holes and into the two holes in each of the isolantite bases. Pin (1) is used in the smaller and pin (3) in the larger of the two holes in each base. The new isolantite base is then likewise located so that when soldered into place its desired position is up against the line-up bar as are all others. The eight pins and the line-up bar are then removed and the r-f strip parts and leads previously unsoldered, are resoldered to the new isolantite base, all dressed as they were previously by duplicating an r-f strip kept on hand for purposes of a sample.

7–3. SELECTIVITY SWITCH. The selectivity switch which provides three crystals and three non-crystal positions of receiver acceptance bandwidth is a three section wafer type switch assembly which is assembled to the receiver with other parts as outlined in paragraph 4–5, assembled to it. It is recommended that the switch assembly be replaced as a unit as compared to replacing any one of the wafers comprising it, the reason being that the switch is purchased as a unit, the replacement of a wafer being a complicated procedure due to the fact that its contact construction assembly is peculiar to the receiver.

7–4. RETROPICALIZATION. The soldered joints, r-f coils, and r-f chokes in the radio receiver are all treated with fungicidal varnish to render them moisture and fungus proofed.

a. In the instance of coils and chokes, not otherwise damaged, but where the tropicalization requires some touch-up, a small brush dipped in the JAN Specification JAN–C–173 varnish, thinned down with approved thinner as per Federal Specification PTX–916 Grade B, may be used to brush the varnish on the coil or choke, as needed.

b. In the instance of soldered joints, subsequent to resoldering, each joint is treated with the varnish by brushing the varnish to completely cover the soldered joint.

c. In the instance when any soldered joint, even when not a resoldered joint, is found to be poorly treated with the varnish, it should be retreated to provide for its complete varnish coverage.

# SECTION VIII
# REASSEMBLY AND TESTING OF SUBASSEMBLIES AND ASSEMBLIES

8–1. REASSEMBLY. The reassembly of the radio receiver comprises the separate reassembly of the receiver chassis assembly and the receiver tuning unit assembly. The receiver chassis reassembly need not follow a specific step sequence, other than that the main cable wiring assembly be added first and the selectivity switch assembly referred to in paragraph 4–5 be assembled last to the receiver chassis. The frequency control unit and audio filter assemblies referred to in paragraph 4–6 may be reassembled to the receiver chassis assembly prior to reassembling the receiver tuning unit and chassis assemblies.

8–2. REASSEMBLY OF TUNING UNIT ASSEMBLY. Before attempting to reassemble the tuning unit assembly, it is recommended that the following step procedure be understood fully so that the various reassembly requirements are anticipated during the actual assembly. The tuning unit assembly comprises the several subassemblies listed in paragraph 4–3. Of these the gear-train assembly (figure 4–1), consists of a tuning unit shield assembly (45) and a mounting disk and shaft assembly (35) which are reassembled subsequent to the addition of the base plate assembly (43) to the tuning unit shield assembly (45). The gears, parts, etc., which comprise the gear-train are then built up on the base plate assembly (43) to completely reassemble the gear-train assembly.

a. Reassemble the tuning unit shield assembly (43, figure 4–1), noting that one each of the three flat springs (46) are associated with each reinforcing plate of the tuning unit shield assembly (45). The flat spring (46) is seated on the reinforcing plate prior to assembly, the swage tool (1, figure 2–2), and mounting (2) being used to swage the reinforcing plate metal so as to properly seat and firmly retain the spring.

b. Reassemble the tuning unit shield assembly (45) to the base plate (43).

c. Reassemble mounting disk and shaft assembly (35), using the jig fixture (1, figure 2–3), the rod (2), and the spanner (3). The rod is used to line up the eight mounting disks by meshing with the locating holes in each so that when the fixture is used to seat the mounting disk and shaft assembly parts, the disk alignment requirements are met prior to tightening the assembly with the spanner.

d. Reassemble the mounting disk and shaft assembly (35, figure 4–1) to the tuning unit shield and base plate assembly by locating the curved washer (41) on the large nut at the front end of the mounting disk and shaft assembly (35) and then seating the combination in the tuning unit shield and base plate assembly.

e. Add front bearing hub (36) to front end of the mounting disk and shaft assembly (35), using three No. 8–32 machine screws (40) and three split lock washers (39). Also add the machine screw (42), it acting as the rear bearing for same. Make sure the curved washer (41) is centered on large nut at front end of the mounting disk and shaft assembly (35) before tightening the two bearings. Lubricate both bearings using Military Specification MIL–G–3278 Grease.

f. Use rod (2, figure 2–3) to line up mounting disk and shaft assembly and tuning unit shield and base assembly, through means of the alignment holes in each, so that the conversion switch cam at the rear of the mounting disk and shaft assembly is in its high position when the switch blade of the conversion switch, assembled to the tuning unit shield assembly, shorts its center fixed contact to its fixed contact closest to the edge of the tuning unit shield assembly.

g. Add the two loop type springs (44) to the top of the base plate assembly (43) and add the anchor plate (33) for the r-f strip, using two No. 6–32 machine screws (34), to the base plate (43).

h. Add the large spur type gear (37) and the small spur type gear (38) using three No. 8–32 machine screws (40) and three split lockwashers (39), to the hub (36). Also add the gear assembly (31), using two No. 6–32 machine screws (32), to the bottom left side of the base plate (43), but do not tighten the assembly.

i. Add the three mounting posts (7), using three No. 10–32 machine screws (11).

j. Add the gear assembly (21) by locating it to the ball bearing (20) at the base plate assembly (43) provision for same with Military Specification MIL–G–3278 Grease, and to the other ball bearing (20), located with grease, at the bearing set screw (18) mounted on the bearing plate (10) by the nut (19); and then holding it in place by mounting the bearing plate (10), carrying the lubricated loosely mounted gear assembly (16), to the two top posts (7) using two No. 10–32 machine screws (11).

k. Lubricate, using Military Specification MIL–G–3278 Grease, the five tempered shafts on the base plate assembly (43).

l. Locate the drive pin assembled to the gear assembly (21), by turning the latter so that the drive pin is at the top of the slot in the base plate assembly (43). Add the two spur type gear assembly (26) to the spider assembly at the top right of the base plate assembly (43) and mesh with the vernier dial spur type gear (27), added to the adjacent shaft contained on the base plate assembly (43), so that the stop pin of the spur type gear (27) is radial with the center of the two spur type gear assembly (26) and against one of the buttons contained thereon when the spur type gear (27) is turned clockwise. Now back away the gear assembly (21) so that the drive pin contained thereon is one tooth (maximum of two teeth) away from its position at the top of the slot in the base plate assembly (43), and mesh in this position with the two spur type gear assembly (26). Having engaged gears in this manner, install "C" washer retainer rings (30) one on each of the shafts, namely the spider shaft and the shaft adjacent to it. Use the pliers (1, figure 2–4) to tighten the retainer rings.

m. Add the spur type gear (28) to the top left spider on the base plate assembly (43). Also add the main dial hub spur type gear (29) to the shaft adjacent to the spider. With the vernier dial spur type gear (27) so that its stop pin is up against the button stop as outlined above in paragraph 8–2, the upper tapped hole in the main dial hub spur type gear (29) is located so that a straightedge bisects said tapped hole when the straightedge is butted up against the shafts which carry the main dial hub spur type gear (29) and the spur type gear (28). Add retainer rings (30) one each to the shafts carrying gears (28) and (29).

n. Add idler wheel (23) to the bottom spider on the base plate assembly (43). Lubricate the shaft of flywheel (22) and the shaft of gear assembly (24) using Military Specification MIL–G–3278 Grease, add the cam (25) to the latter and mount all of same with the bearing plate (9), using one No. 10–32 machine screw (11) for the bottom post (7), and two No. 8–32 machine screws (12).

o. Add the band change cam detent roller and lever assembly (6) and the two helical springs (5) for same. Bring cam (25) forward to bearing plate (9) and locate cam in roller, lining up cam with the roller and lever assembly (6), arm, and then tighten the set screws in the cam (25).

p. Check for smooth overall operation and then tighten the two No. 6–32 machine screws (32) which are used to mount the gear assembly (31).

q. Adjust bearing set screw (18) mounted on the bearing plate (10) for no slack but make sure mounting tap is not bent out during the adjustment.

r. Tighten the three machine screws (17) which mount the hub of the gear assembly (16) to the bearing plate (10) so that the gear of the gear assembly (16) meshes properly with the small spur type gear (38) mounted on the front bearing of the mounting disk and shaft assembly (35).

s. Add the movable support main pointer bracket (15), the four retainer disks (13), mounted by the four No. 4–40 machine screws (14) providing for positioning the movable bracket (15). Also add the indicator slide helical spring (2).

t. Add cam, hub, and band change dial assembly (1), locating dial so that hairline on it lines up with that on the jig (2, figure 2–4) used, which is mounted for this purpose over the assembly (1, figure 4–1) on the movable bracket (15) and its mounting.

u. Add main and vernier dials, and dial indicator pointers, setting dials to the indicators so that both dials start from zero dial indication. Add main dial pointer to movable bracket (15) with the pointer set to the main dial first frequency mark line.

8–3. RESOLDERING AND RETROPICALIZATION. The reassembly of the radio receiver requires that all electrical wires which were unsoldered, to dismantle and disassemble the radio receiver, be resoldered. Subsequent to resoldering each soldered joint must be completely covered with fungicidal varnish, approved as per JAN Specification JAN–C–173, by brushing each joint with a small brush dipped in same. To maintain performance, all electrical wires and part lead lengths, the electrical wires prewired to subassemblies and parts, their dressing and the dressing of all parts, the manner and location of each ground connection, must duplicate in each instance the factory techniques incorporated into each radio receiver.

8–4. TESTING OF SUBASSEMBLIES AND ASSEMBLIES. The test procedure used with regard to a receiver subassembly is to reassemble the repaired subassembly or a new one to the receiver and then to test the radio receiver as outlined in AN 16–45–434, the Handbook of Service Instructions.

# SECTION IX
# REASSEMBLY AND TESTING OF COMPONENTS

9–1. REASSEMBLY. The reassembly sequence of the radio receiver is to reassemble the subassemblies comprising it separately and then, in turn, to reassemble the subassemblies into an assembly to which is added the bottom plate and top cover. The subassemblies themselves comprise sub-subassemblies some of which only involve the addition of parts to other parts to facilitate their subsequent subassembly assembly as outlined in paragraph 4–5.

9–2. REASSEMBLY OF THE CHASSIS AND TUNING UNIT ASSEMBLY. The procedure to reassemble the chassis and tuning unit assembly is to add the tuning unit assembly described in paragraph 8–2, including the gear-train assembly and the tuning unit shield assembly, to the chassis assembly described in paragraph 8–1, in the following manner.

a. Seat the tuning unit assembly into the chassis assembly.

b. Fasten the tuning unit assembly at its rear end to the chassis assembly, using a No. 10–32 machine screw with included external-tooth washer, by passing the screw thru the angle bracket on the tuning unit assembly and thru the hole in the chassis assembly, and then adding a No. 10 lockwasher and a No. 10 nut to the No. 10–32 machine screw.

c. Fasten the tuning unit assembly at its front end to the chassis assembly, using two No. 10–32 machine screws with included external-tooth lockwasher, and one stud screwed into a spacer post, at either front side of the tuning unit assembly, by passing the two screws and the stud thru clearance holes in the chassis assembly to screw into two nut plate brackets used.

d. Resolder two red/green, one green/red, and one yellow/red lead of the main wiring cable to the S4 conversion switch.

e. Resolder one white/black, one red/white, one blue/red, one yellow/black, and one red/green lead, comprising leads from the terminal board E13 adjacent to the filter assembly, to the top terminal strip of the mixer plate transformer assembly T1 on the tuning unit assembly.

f. Resolder the two blue/black leads of the tuning unit assembly to the T2 second mixer input transformer.

g. Resolder the two green/white leads of the tuning unit assembly, one to the E17 terminal board at the front of the chassis assembly alongside the selectivity switch, and the other to the E14 terminal board normal to the former at the front end of the switch.

h. Retropicalize all soldered joints as outlined in paragraph 7–4.

9–3. REASSEMBLY OF THE CHASSIS AND PANEL ASSEMBLY. The procedure to reassemble the chassis and panel assembly is to assemble the receiver front panel assembly to the chassis and tuning unit assembly described in paragraph 9–2, in the following manner.

a. Fasten the front panel assembly to the chassis and tuning unit assembly using eight, one inch No. 10–32 machine screws, four on each side of the front panel, and two, half-inch No. 10–32 machine screws at the bottom of the front panel, the latter screwing into the spacer posts used in the reassembly of the tuning unit assembly to the chassis assembly. Each No. 10–32 machine screw has a No. 10 lockwasher added to it.

b. Relocate all toggle, the bfo-avc, and the i-f-o switches, and the phones jack, and fasten each to the front panel, using the nut located on the shaft bushing of each, during disassembly.

c. Relocate all four flexible couplings to engage their respective shafts contained in the front panel and tighten the set screws contained in each.

d. Add the r-f gain, tuning, band change, bfo-avc, i-f-o and audio gain knobs to the appropriate control shaft of each and tighten the set screws contained in each.

e. Assemble the small eccentric, the large eccentric, and tie rod, which together provide the drive assembly for the S3 crystal switch located on the base plate of the gear-train assembly, and add the large eccentric to the extension shaft of the S2 crystal selector switch. Now locate the extension shaft into the fixed coupling at the frequency control unit and through the clearance hole for it in the front panel. Seat the small eccentric on the shaft of the S3 crystal switch and locate the tie rod so that it is normal to the extension shaft. Tighten the set screws in the fixed coupling and those on the small and the large eccentric so that when the crystal switch S3 is in its most clockwise position, the crystal selector switch S2 is in the first crystal position. Then locate the S2 eccentric drive to the drive end of its groove, back it up slightly, and tighten. Add the small helical spring to the S3 crystal switch, and the knob to the extension shaft at the front panel.

9–4. REASSEMBLY OF THE R-F TUNERS. The 24 r-f tuners or r-f subassemblies are considered part of the tuning unit assembly proper. Even so, they may be reassembled to the chassis and tuning unit assembly,

TABLE 9–1. IDENTIFICATION OF THE R-F TUNERS

| BAND NO. | MC FREQ RANGE | INPUT | HAMMARLUND PART/DRAWING NO. | | |
|---|---|---|---|---|---|
| | | | INTERSTAGE | | OSCILLATOR |
| 1 | 0.54–1.35 | 31387–1 | 31386–1 | 31386–1 | 31385–1 |
| 2 | 1.35–3.45 | 31390–1 | 31389–1 | 31389–1 | 31388–1 |
| 3 | 3.45–7.40 | 31393–1 | 31392–1 | 31392–1 | 31391–1 |
| 4 | 7.40–14.80 | 31396–1 | 31395–1 | 31395–1 | 31394–1 |
| 5 | 14.80–29.70 | 31399–1 | 31398–1 | 31398–1 | 31397–1 |
| 6 | 29.70–54.00 | 31405–1 | 31404–1 | 31404–1 | 31403–1 |

or to the chassis and panel assembly, preferably to the latter. Each r-f tuner has stamped on its steatite base the Hammarlund part/drawing number applicable to it. Table 9–1 identifies each r-f tuner so that it may be properly reassembled to the chassis and panel assembly of the receiver. For each frequency band the input r-f tuners are reassembled to the rear end of the rotor and mounting disk assembly contained in the tuning unit assembly. Next in reassembly sequence are the two interstate r-f tuners, the oscillator r-f tuner for each band being reassembled to the rotor and mounting disk assembly nearest to the front panel of the receiver. When making the reassembly, the r-f tuners are reassembled to the one of the two most exposed positions of the rotor and mounting disk assembly as viewed from the bottom of the receiver, so that when the band change control knob on the front panel is turned clockwise, the reassembled r-f tuners move to the other most exposed position of the rotor and mounting disk assembly. The reassembly of the Band No. 4 r-f tuners is made with the band change dial set for Band No. 1, so that when the band change control knob on the front panel is turned clockwise the r-f tuners for Band No. 5, 6, 1, 2, and 3 are reassembled in sequence.

9–5. REASSEMBLY OF THE PLUG CONNECTOR ASSEMBLIES. Prior to the reassembly of the radio receiver as outlined in paragraph 9–6, plug connect the seven receiver plug connector assemblies to the receiver chassis and panel assembly, as outlined in AN 16–45–434, the Handbook of Service Instructions. Of these P1, P2, P6, and P7 are identical, each comprising a plug connector PL–259, a reducing adapter UG–176/U, and an angle plug adapter M–359. P5 comprises an AN 3108B–18–3S plug with a cable clamp AN 3057–10. P4 comprises an AN 3108B–14S–2P plug with a cable clamp AN 3057–6. P8 comprises a plug connector PL–259 and a reducing adapter UG–176/U.

9–6. REASSEMBLY OF THE RADIO RECEIVER. The final step in the reassembly of the radio receiver is to add the bottom plate and then the top cover to the chassis and panel assembly described in paragraph 9–3, in the following manner.

a. Reassemble the bottom plate using seven No. 10–32 machine screws with included external-tooth lockwashers.

g. Reassemble the top cover including a rubber packing strip, by butting the rubber packed end of the top cover up against the panel of the chassis and panel assembly while tightening the four thumb screws, each of which passes thru one of the four mounting brackets which form part of the top cover proper.

9–7. TESTING. The chassis and panel assembly described in paragraph 9–3, subsequent to reassembly, is aligned and adjusted as per the instructions outlined in AN 16–45–434, the Handbook of Service Instructions. The receiver, also, is tested with regard to the minimum performance standards specified for it therein.

# SECTION X
# FINAL ASSEMBLY

10–1. GENERAL. The reassembly of the radio receiver outlined in paragraph 9–6 comprises the final reassembly of the complete equipment.

# SECTION XI
# INSPECTION AND TESTING

11–1. GENERAL. The radio receiver comprising the complete equipment is aligned, inspected, and tested with regard to the considerations outlined in AN 16–45–434, the Handbook of Service Instructions.

**Note**

Markings of equipments required by Government T.O.'s or other instructions, to indicate overhaul or the incorporation of changes shall be applied during inspection and test (if not previously applied to subassemblies, assemblies, or components during overhaul and assembly).

11–2. MINIMUM PERFORMANCE AND TEST VALUES. The minimum mechanical performance and electrical test standards applicable to the radio receiver, comprising the complete equipment, are those outlined and specified in AN 16–45–434, the Handbook of Service Instructions. No tolerances are applicable to the mechanical performance of the receiver, while the electrical test standards specified for the receiver may be exceeded but never "opened up" to provide for the acceptance of a specific receiver. The performance of each radio receiver used in an operational activity, comprising other electronic equipment, duplicates that of the receiver as separately inspected and tested to conform to its minimum performance and test values. The adequate shielding incorporated into the receiver design precludes the possibility of receiver radiation to any associated equipment.

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# HANDBOOK
# PREVENTIVE MAINTENANCE
# INSTRUCTIONS

# HAMMARLUND RADIO RECEIVER

## MODELS SP-600-JX-17 AND SP-600-JX-21

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# INTRODUCTION

## 1. PURPOSE

This handbook establishes standardized work methods and simplified step-by-step job instructions for the preventive maintenance of this equipment. The individual job instructions, in the form of "Routines," are presented simply and logically to permit their ready use by maintenance personnel. Adequate performance standards are included.

## 2. SCOPE

These job instructions are applicable to and will be used by all activities maintaining the equipment.

## 3. SPECIAL INSTRUCTIONS

This handbook will be used as a portion of the standardized communications electronics maintenance inspection system. Personnel using this handbook shall notify supervisory personnel immediately if satisfactory performance cannot be obtained.

## SCHEDULE FOR ACCOMPLISHMENT OF ROUTINES

(Intervals are in days, for example "30" means "every thirty days.")

| Routine Number | CONTINUOUS OPERATION | | | | TACTICAL OPERATION | | | | STANDBY OPERATION | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Temperate | Arctic | Tropic | Desert | Temperate | Arctic | Tropic | Desert | Temperate | Arctic | Tropic | Desert |
| 1.1(6) | | | | | Deleted | | | | | | | |
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| 1.6(6) | 7 | 7 | 5 | 5 | 7 | 7 | 5 | 5 | 30 | 30 | 15 | 10 |
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| 2.3(5) | * | * | * | * | * | * | * | * | * | * | * | * |
| 2.4(5) | * | * | * | * | * | * | * | * | * | * | * | * |
| 2.5(5) | * | * | * | * | * | * | * | * | * | * | * | * |
| 3.1(1) | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 60 | 60 | 30 | 30 |

* Accomplishment to be directed by maintenance supervisor.

PERFORMANCE TEST - RADIO RECEIVERS
SP-600-JX-21 AND SP-600-JX-17

Routine 1.1(6), original pages 1 thru 10, deleted

# PERFORMANCE TEST - RADIO RECEIVERS SP-600-JX-21 AND SP-600-JX-17, POWER SUPPLY

## 1. GENERAL INFORMATION

a. The purpose of this routine is to determine if the power supply of Radio Receiver SP-600-JX-21 or Radio Receiver SP-600-JX-17 is operating properly.

b. The approximate time required to do this routine is 1-1/2 man-hours.

c. Report all indications that are not within tolerance to the maintenance supervisor for corrective action.

## 2. TEST EQUIPMENT REQUIRED

a. Multimeter AN/PSM-6

## 3. MATERIAL REQUIRED

a. Screwdriver

b. Resistor, 600-ohm, 2-watt, non-inductive

## 4. PROCEDURE

a. Preliminary Procedure

(1) Disconnect the power line plug of the radio receiver from the power source.

(2) Disconnect the loudspeaker from the AUDIO OUTPUT terminals.

(3) Disconnect the BFO, IFO, DIODE OUTPUT and AVC leads from their respective terminals.

(4) Disconnect the antenna cable from the antenna input connector.

(5) Remove the eight screws holding the radio receiver in the relay rack and remove the receiver from the rack.

(6) Loosen the four thumb screws holding the top cover to the radio receiver and remove the cover.

(7) Set the radio receiver on its side. Remove the seven machine screws holding the bottom plate to the radio receiver and remove the plate.

(8) Insert the power line plug of the radio receiver into the 115-volt, 60-cycle power source.

(9) Connect the 600-ohm, 2-watt resistor between the AUDIO OUTPUT terminals on the rear of the radio receiver.

(10) Set the FUNCTION switch on Multimeter AN/PSM-6 to the DCV-20K Ω /V position.

(11) Set the RANGE switch on Multimeter AN/PSM-6 to the Ω x 10000/500 position.

(12) Insert the red test lead into the red jack of the multimeter and the black test lead into the black jack of the multimeter.

(13) Slip a red alligator clip over the red test prod point and a black alligator clip over the black test prod point.

(14) Connect the black test lead to the receiver chassis and the red test lead to the junction of L-51, L-52, and C-161B (figure 1-3).

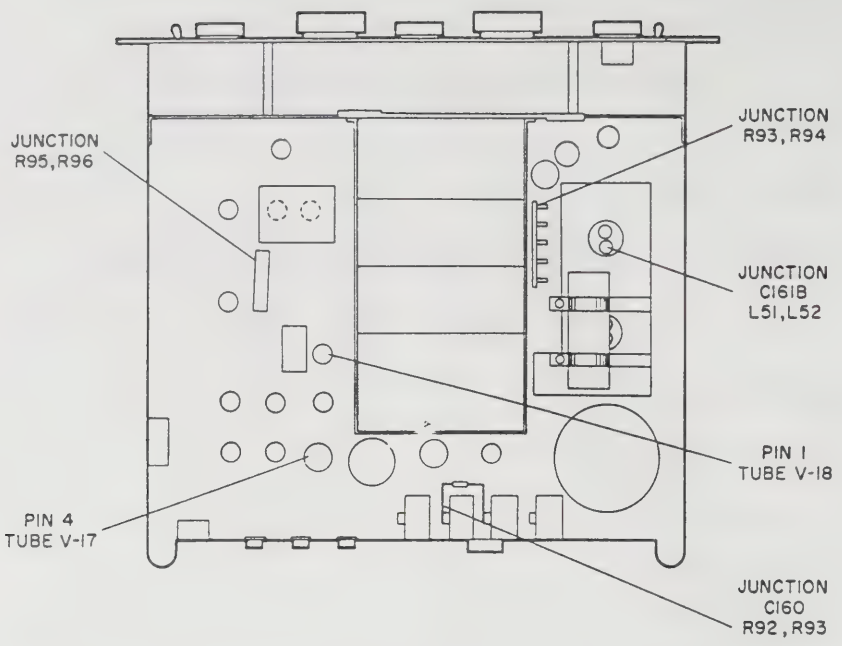


Figure 1-3. Radio Receivers SP-600-JX-21 and SP-600-JX-17, Bottom View

b. Measure the output voltages of the radio receiver power supply as follows:

(1) Rotate the RF GAIN control on the radio receiver clockwise from the OFF position to 10. The indication on the multimeter should be between 270 and 290 volts.

WARNING

When the RF GAIN control is not in the OFF position, dangerous voltages are present in the unit under test. In succeeding steps of this routine, observe all safety precautions when this control is not set to OFF.

(2) Rotate the RF GAIN control counterclockwise to 0. The indication on the multimeter should be between 295 and 315 volts.

(3) Rotate the RF GAIN control on the radio receiver counterclockwise to the OFF position.

(4) Set the RANGE switch on the multimeter to the Ω x 1000/250 position.

(5) Remove the red test lead from the junction of L-51, L-52, and C-161B and connect it to pin 4 of tube V-17 (figure 1-3).

(6) Rotate the RF GAIN control on the radio receiver clockwise from the OFF position to 10. The indication on the multimeter should be between 220 and 235 volts.

(7) Set the RANGE switch on the multimeter to the Ω x 10000/500 position.

(8) Rotate the RF GAIN control on the radio receiver counterclockwise to 0. The indication on the multimeter should be between 255 and 275 volts.

(9) Rotate the RF GAIN control on the radio receiver counterclockwise to the OFF position.

(10) Set the RANGE switch on the multimeter to the Ω x 1000/250 position.

(11) Remove the red test lead from pin 4 of tube V-17 and connect it to pin 1 of tube V-18 (figure 1-3).

(12) Rotate the RF GAIN control on the radio receiver clockwise from the OFF position to 0. The indication on the multimeter should be between 145 and 155 volts.

(13) Rotate the RF GAIN control on the radio receiver counterclockwise to the OFF position.

(14) Remove the red test lead from pin 1 of tube V-18 and connect it to the radio receiver chassis (ground). Remove the black test lead from the radio receiver chassis (ground) and connect it to the junction of C-160, R-92, and R-93 (figure 1-3).

(15) Rotate the RF GAIN control on the radio receiver clockwise from the OFF position to 0. The indication on the multimeter should be between 50 and 53 volts.

(16) Rotate the RF GAIN control on the radio receiver counterclockwise to the OFF position.

(17) Set the RANGE switch on the multimeter to the Ω x 100/50 position.

(18) Remove the black test lead from the junction of C-160, R-92, and R-93 and connect it to the junction of R-95 and R-96 (figure 1-3).

(19) Rotate the RF GAIN control on the radio receiver clockwise from the OFF position to 0. The indication on the multimeter should be between 9. 5 and 10. 5 volts.

(20) Rotate the RF GAIN control on the radio receiver counterclockwise to the OFF position.

(21) Set the RANGE switch on the multimeter to the Ω x 1/25 position.

(22) Remove the black test lead from the junction of R-95 and R-96 and connect it to the junction of R-93 and R-94 (figure 1-3).

(23) Rotate the RF GAIN control on the radio receiver clockwise from the OFF position to 10. Set the AVC-MAN switch on the radio receiver to the MAN position. The indication on the multimeter should be between 0. 95 and 1. 0 volt.

(24) Rotate the RF GAIN control on the radio receiver counterclockwise to the OFF position.

c. Concluding Procedure

(1) Remove the multimeter test leads from the radio receiver.

(2) Remove the 600-ohm, 2-watt resistor from the radio receiver AUDIO OUTPUT terminals.

(3) Disconnect the power line plug of the radio receiver from the power source.

(4) Replace the bottom plate on the radio receiver and tighten the seven machine screws.

(5) Replace the top cover of the radio receiver and tighten the four thumb screws.

(6) Place the radio receiver in the relay rack and tighten the eight holding screws.

(7) Connect all the cables and wires to their respective terminals on the rear of the radio receiver.

(8) Insert the power line plug of the radio receiver into the 115-volt, 60-cycle power source.

PERFORMANCE TEST - RADIO RECEIVERS SP-600-JX-21 AND SP-600-JX-17, SENSITIVITY

Routine 1.3(2), original pages 15 thru 20, deleted

# PERFORMANCE TEST - RADIO RECEIVERS SP-600-JX-21 AND SP-600-JX-17, SELECTIVITY

Routine 1.4(3), original pages 21 thru 26, deleted

# PERFORMANCE TEST - RADIO RECEIVERS SP-600-JX-21 AND SP-600-JX-17, INTERMEDIATE-FREQUENCY REJECTION RATIO

## 1. GENERAL INFORMATION

a. The purpose of this routine is to check the rejection ratio of the intermediate-frequency stages of Radio Receiver SP-600-JX-21 or SP-600-JX-17.

b. The approximate time required to do this routine is 2 man-hours.

c. Report all indications that are not within tolerance to the maintenance supervisor for corrective action.

## 2. TEST EQUIPMENT REQUIRED

a. Signal Generator AN/URM-25

b. Electronic Multimeter TS-505( )/U

## 3. MATERIAL REQUIRED

a. Screwdriver

b. Soldering iron

c. Resistor, 600-ohm, 2-watt, non-inductive

d. Resistors, 121-ohm, 1/2-watt, non-inductive, two

e. Black test lead

f. Two alligator clips

g. Connector plug PL-259

h. Connector plug UG-102/U

i. One 30-inch length of RG-22/U cable

j. One 30-inch length of RG-59/U cable

k. Antenna test cable for Radio Receiver SP-600-JX-21 fabricated as follows:

(1) Remove 1-1/8 inches of outer insulation from both ends of the RG-22/U cable and cut the braid back 3/4 inch.

(2) Strip 5/8 inch of insulation from both conductors and tin the exposed conductors and braid.

(3) Disassemble the connector plug, UG-102/U, and slide the coupling ring on the cable. Screw the back shell to the cable, aligning the solder hold with the conductors.

(4) Assemble the front shell to the back shell so that both solder holes are in line.

(5) Solder the braid to the shells through the solder holes and solder the conductors to the contacts.

(6) Screw the coupling ring to the back shell.

(7) Strip 5/8 inch of insulation from the center conductors on the other end of the cable.

(8) Solder a 121-ohm, 1/2-watt resistor between the two conductors.

l. Antenna test cable for Radio Receiver SP-600-JX-17 fabricated as follows:

(1) Remove 1-1/8 inches of outer insulation from both ends of the RG-59/U cable and cut the braid back 3/4 inch.

(2) Strip 5/8 inch of insulation from the center conductor and tin the exposed conductor and braid.

(3) Disassemble the connector plug, PL-259, and slide the coupling ring on the cable. Screw the plug subassembly to the cable.

(4) Solder the braid to the assembly through the solder hole and solder the center conductor to the contact.

(5) Screw the coupling ring to the plug subassembly.

(6) Unravel the exposed braid at the other end of the cable and twist it to form a lead. Strip 5/8 inch of insulation from the center conductor.

(7) Solder a 121-ohm, 1/2-watt resistor between the center conductor and the braid.

4. PROCEDURE

a. Preliminary Procedure

(1) Disconnect the power line plug of the radio receiver from the power source.

(2) Disconnect the loudspeaker from the AUDIO OUTPUT terminals.

(3) Disconnect the antenna cable from the antenna input connector.

(4) Disconnect the BFO, IFO, DIODE OUTPUT, and AVC connections from their respective terminals.

(5) Remove the eight screws holding the receiver in the relay rack and remove the receiver from the rack.

(6) Loosen the four thumb screws holding the top cover to the radio receiver and remove the cover.

(7) Insert the power line plug of the radio receiver into the 115-volt, 60-cycle power source.

(8) Connect the 600-ohm, 2-watt resistor between the AUDIO OUTPUT terminals on the rear of the radio receiver.

(9) Insert the power line plug of the Electronic Multimeter TS-505( )/U into the 115-volt, 60-cycle power source.

(10) Connect the black test lead to the COMMON binding post on the multimeter.

(11) Connect an alligator clip to the other end of the black test lead and clip the lead to one side of the 600-ohm resistor connected across the AUDIO OUTPUT terminals on the rear of the radio receiver.

(12) Connect an alligator clip to the a-c probe of the multimeter and clip the probe to the other side of the 600-ohm resistor.

(13) Set the RANGE switch on the multimeter to the 4V/R x 10 position.

(14) Set the FUNCTION switch on the multimeter to the A. C. position and allow 3 minutes for the multimeter to warm up.

(15) Set up Signal Generator AN/URM-25( ) to deliver an unmodulated 0. 6-megacycle r-f signal. Set up Signal Generator AN/URM-25 as follows:

(a) Insert the female plug of the power line into the socket located on the lower left corner of the signal generator front panel.

(b) Insert the male plug of the power line into a 115-volt, 60-cycle power source.

(c) Rotate the CARRIER CONTROL and the % MODULATION control on the signal generator fully counterclockwise.

(d) Set the FREQUENCY BAND SWITCH to the Band D position.

(e) Set the CARRIER RANGE switch on the signal generator to the DEFG position.

(f) Rotate the signal generator tuning dial until an indication of 0. 6 megacycle is obtained on the frequency and vernier dials.

(g) Set the MOD SELECTOR switch on the signal generator to the OFF position.

(h) Set the METER READS switch on the signal generator to the RF position.

(i) Set the POWER ON-OFF switch to the ON position and allow 15 minutes for the signal generator to warm up.

(16) Connect the antenna test cable to the antenna input connector of the receiver.

(17) Connect the antenna test cable to the signal generator as follows:

(a) Connect one end of the 121-ohm resistor to the center contact of the signal generator X MULT RF OUTPUT jack.

(b) Connect the other end of the 121-ohm resistor to ground terminal G.

(18) Set up Radio Receiver SP-600-JX-21 for the reception of an amplitude-modulated signal as follows:

(a) Set the SEND-REC switch to the REC position.

(b) Set the FREQ CONTROL switch to the VFO position.

(c) Set the LIMITER-OFF switch to the OFF position.

(d) Set the AVC-MAN switch to the MAN position.

(19) Set up Radio Receiver SP-600-JX-17 for the reception of an amplitude-modulated signal as follows:

(a) Set the SEND-REC switch to the REC position.

(b) Set the IFO switch to the INT position.

(c) Set the HFO switch to the VAR position.

(d) Set the LIMITER-OFF switch to the OFF position.

(e) Set the AVC-MAN switch to the MAN position.

b. Check the 455-kilocycle i-f rejection ratio as follows:

(1) Rotate the RF GAIN control on the radio receiver clockwise from the OFF position to 0.

WARNING

Dangerous voltages are present in the unit under test. Observe all safety precautions.

(2) Set the MOD-CW switch on the radio receiver to the MOD position.

(3) If this check is being performed on Radio Receiver SP-600-JX-17 set the BFO-AVC switch to the INT BFO - FAST position.

(4) Rotate the MICROVOLTS control on the signal generator fully clockwise.

(5) Set the MULTIPLIER switch on the signal generator to the . 1 position and adjust the CARRIER CONTROL until an indication of 100 is obtained on the signal generator output meter.

(6) Set the SELECTIVITY switch on the radio receiver to the 3 NON-XTAL position and adjust the signal generator MICROVOLTS control until an indication of 20 is obtained on the upper scale of the signal generator output meter.

(7) Set the MOD SELECTOR switch on the signal generator to the 400 cycle position and the METER READS switch on the signal generator to the % MOD position.

(8) Adjust the % MODULATION control on the signal generator until an indication of 30 is obtained on the lower scale of the signal generator output meter.

(9) Set the METER READS switch on the signal generator to the RF position and rotate the radio receiver RF GAIN control fully clockwise.

(10) Set the BAND CHANGE switch on the radio receiver until the indication 0. 54 - 1. 35 appears in the MEGACYCLES window.

(11) Adjust the radio receiver TUNING control until an indication of 0. 6 megacycle is obtained on the main tuning and vernier dials.

(12) Set the RANGE SWITCH on the multimeter to the 4V/R x 10 position and adjust the AUDIO GAIN control on the radio receiver until an indication of 2. 45 volts is obtained on the multimeter.

(13) Rotate the CARRIER CONTROL on the signal generator fully counterclockwise and the MICROVOLTS control on the signal generator fully clockwise.

(14) Rotate the signal generator tuning dial until an indication of 0. 455 megacycle is obtained on the frequency and index scales.

(15) Set the MULTIPLIER switch on the signal generator to the 10 position and adjust the CARRIER CONTROL on the signal generator until an indication of 100 is obtained on the signal generator output meter.

(16) Adjust the MICROVOLTS control until an indication of 66. 7 is obtained on the upper scale of the signal generator output meter. The indication on the multimeter should be between 2. 3 and 2. 6 volts.

c. Check the 3955-kilocycle intermediate-frequency rejection ratio as follows:

(1) Rotate the CARRIER CONTROL on the signal generator fully counterclockwise and the MICROVOLTS control on the signal generator fully clockwise.

(2) Set the signal generator FREQUENCY BAND SWITCH to the Band F position.

(3) Set the MOD SELECTOR switch on the signal generator to the OFF position.

(4) Rotate the signal generator tuning dial until an indication of 7. 6 megacycles is obtained on the frequency and index scales.

(5) Set the MULTIPLIER switch on the signal generator to the . 1 position and adjust the CARRIER CONTROL on the signal generator until an indication of 100 is obtained on the signal generator output meter.

(6) Adjust the MICROVOLTS control on the signal generator until an indication of 20 is obtained on the upper scale of the signal generator output meter.

(7) Set the MOD SELECTOR switch on the signal generator to the 400 cycle position.

(8) Rotate the BAND CHANGE switch on the radio receiver until the indication 7.4 - 14.8 appears in the MEGACYCLES window.

(9) Adjust the radio receiver TUNING control until an indication of 7.6 megacycles is obtained on the main tuning and vernier dials.

(10) Adjust the AUDIO GAIN control on the radio receiver until an indication of 2.45 volts is obtained on the multimeter.

(11) Rotate the CARRIER CONTROL on the signal generator fully counterclockwise and the MICROVOLTS control on the signal generator fully clockwise.

(12) Set the MOD SELECTOR switch on the signal generator to the OFF position.

(13) Rotate the signal generator tuning dial until an indication of 3.9 megacycles is obtained on the frequency and vernier scales.

(14) Set the MULTIPLIER switch on the signal generator to the 1 position and adjust the CARRIER CONTROL on the signal generator until an indication of 100 is obtained on the signal generator output meter.

(15) Adjust the MICROVOLTS control on the signal generator until an indication of 40 is obtained on the upper scale of the signal generator output meter.

(16) Set the MOD SELECTOR switch on the signal generator to the 400 cycle position and observe the multimeter. The indication on the multimeter should be between 2.3 and 2.6 volts.

d. Concluding Procedure

(1) Rotate the RF GAIN control on the radio receiver fully counterclockwise to the OFF position.

(2) Set the signal generator POWER ON-OFF switch to the OFF position and disconnect the antenna test cable from the radio receiver.

(3) Disconnect the power line plug of the signal generator from the power source.

(4) Disconnect the multimeter test leads from the radio receiver and the power line plug of the multimeter from the power source.

(5) Disconnect the power line plug of the radio receiver from the power source.

(6) Remove the 600-ohm, 2-watt resistor from the AUDIO OUTPUT terminals on the rear of the radio receiver.

(7) Replace the top cover on the radio receiver and tighten the four thumb screws.

(8) Replace the radio receiver in the relay rack and tighten the eight holding screws to secure the radio receiver.

(9) Connect all the cables and wires to their respective terminals on the rear of the radio receiver.

(10) Insert the power line plug of the radio receiver into the 115-volt, 60-cycle power source.

# PERFORMANCE TEST - RADIO RECEIVERS SP-600-JX-21 AND SP-600-JX-17, IMAGE REJECTION RATIO

## 1. GENERAL INFORMATION

a. The purpose of this routine is to check the image rejection of Radio Receiver SP-600-JX-21 or SP-600-JX-17.

b. The approximate time required for this routine is 2 man-hours.

c. Report all indications that are not within tolerance to the maintenance supervisor for corrective action.

## 2. TEST EQUIPMENT REQUIRED

a. Signal Generator AN/URM-25

b. Electronic Multimeter TS-505( )/U

## 3. MATERIAL REQUIRED

a. Screwdriver

b. Soldering iron

c. Resistor, 600-ohm, 2-watt, non-inductive

d. Resistor, 121-ohm, 1/2-watt, non-inductive, two

e. Black test lead

f. Two alligator clips

g. Connector plug PL-259

h. Connector plug UG-102/U

i. One 30-inch length of RG-22/U cable

j. One 30-inch length of RG-59/U cable

k. Antenna test cable for Radio Receiver SP-600-JX-21 fabricated as follows:

(1) Remove 1-1/8 inches of outer insulation from both ends of the RG-22/U cable and cut the braid back 3/4 inch.

(2) Strip 5/8 inch of insulation from both conductors and tin the exposed conductors and braid.

(3) Disassemble the connector plug, UG-102/U, and slide the coupling ring on the cable. Screw the back shell to the cable, aligning the solder hole with the conductors.

(4) Assemble the front shell to the back shell so that both solder holes are in line.

(5) Solder the braid to the shells through the solder holes and solder the conductors to the contacts.

(6) Screw the coupling ring to the back shell.

(7) Strip 5/8 inch of insulation from the center conductors on the other end of cable.

(8) Solder a 121-ohm, 1/2-watt resistor between the two conductors.

1. Antenna test cable for Radio Receiver SP-600-JX-17 fabricated as follows:

(1) Remove 1-1/8 inches of outer insulation from both ends of the RG-59/U cable and cut the braid back 3/4 inch.

(2) Strip 5/8 inch of insulation from the center conductor and tin the exposed conductor and braid.

(3) Disassemble the connector plug, PL-259, and slide the coupling ring on the cable. Screw the plug subassembly on the cable.

(4) Solder the braid to the assembly through the solder hole and solder the center conductor to the contact.

(5) Screw the coupling ring to the plug subassembly.

(6) Unravel the exposed braid at the other end of the cable and twist it to form a lead. Strip 5/8 inch of insulation from the center conductor.

(7) Solder a 121-ohm, 1/2-watt resistor between the center conductor and the braid.

4. PROCEDURE

a. Preliminary Procedure

(1) Disconnect the power line plug of the radio receiver from the power source.

(2) Disconnect the loudspeaker from the AUDIO OUTPUT terminals.

(3) Disconnect the antenna cable from the antenna input connector.

(4) Disconnect the BFO, IFO, DIODE OUTPUT and AVC connections from their respective terminals.

(5) Remove the eight screws holding the radio receiver in the relay rack and remove the receiver from the rack.

(6) Loosen the four thumb screws holding the top cover to the radio receiver and remove the cover.

(7) Insert the power line plug of the radio receiver into the 115-volt, 60-cycle power source.

(8) Connect the 600-ohm, 2-watt resistor between the AUDIO OUTPUT terminals on the rear of the radio receiver.

(9) Insert the power line plug of Electronic Multimeter TS-505( )/U into a 115-volt, 60-cycle power source.

(10) Connect the black test lead to the COMMON binding post on the multimeter.

(11) Connect an alligator clip to the other end of the black test lead and clip the lead to one side of the 600-ohm resistor connected across the AUDIO OUTPUT terminals on the rear of the radio receiver.

(12) Connect an alligator clip to the a-c probe of the multimeter and clip the probe to the other side of the 600-ohm resistor.

(13) Set the RANGE switch on the multimeter to the 4V/R x 10 position.

(14) Set the FUNCTION switch on the multimeter to the A.C. position and allow 3 minutes for the meter to warm up.

(15) Set up Signal Generator AN/URM-25( ) to deliver an unmodulated 2.26-megacycle r-f signal. Set up Signal Generator AN/URM-25 as follows:

(a) Insert the female plug of the power line into the socket on the lower left

corner of the signal generator front panel.

(b) Insert the male plug of the power line into the 115-volt, 60-cycle power source.

(c) Rotate the CARRIER CONTROL and the % MODULATION control on the signal generator fully counterclockwise.

(d) Set the FREQUENCY BAND SWITCH on the signal generator to the Band F position.

(e) Set the CARRIER RANGE switch on the signal generator to the DEFG position.

(f) Rotate the signal generator tuning dial until an indication of 2.26 megacycles is obtained on the frequency and index scales.

(g) Set the MOD SELECTOR switch on the signal generator to the OFF position.

(h) Set the METER READS switch on the signal generator to the RF position.

(i) Set the POWER ON-OFF switch to the ON position and allow 15 minutes for the signal generator to warm up.

(16) Connect the antenna test cable to the antenna input connector of the receiver.

(17) Connect the antenna test cable to the signal generator as follows:

(a) Connect one end of the 121-ohm resistor to the center contact of the signal generator X MULT RF OUTPUT jack.

(b) Connect the other end of the 121-ohm resistor to ground terminal G.

(18) Set up Radio Receiver SP-600-JX-21 for the reception of an amplitude-modulated signal as follows:

(a) Set the SEND-REC switch to the REC position.

(b) Set the FREQ CONTROL switch to the VFO position.

(c) Set the LIMITER-OFF switch to the OFF position.

(d) Set the AVC-MAN switch to the AVC position.

(19) Set up Radio Receiver SP-600-JX-17 for the reception of an amplitude-modulated signal as follows:

(a) Set the SEND-REC switch to the REC position.

(b) Set the IFO switch to the INT position.

(c) Set the HFO switch to the VAR position.

(d) Set the LIMITER-OFF switch to the OFF position.

(e) Set the AVC-MAN switch to the MAN position.

b. Check the radio receiver image rejection ratios as follows:

(1) Rotate the RF GAIN control on the radio receiver fully clockwise.

WARNING

Dangerous voltages are present in the unit under test. Observe all safety precautions.

(2) Set the MOD-CW switch on the radio receiver to the MOD position.

(3) If this check is being performed on radio receiver SP-600-JX-17, set the BFO-AVC switch to the INT-BFO - FAST position.

(4) Rotate the signal generator MICROVOLTS control fully clockwise.

(5) Set the MULTIPLIER switch on the signal generator to the 1 position and adjust the CARRIER CONTROL on the signal generator until an indication of 100 is obtained on the signal generator output meter.

(6) Set the SELECTIVITY switch on the radio receiver to the 3 NON-XTAL position and adjust the signal generator MICROVOLTS control until an indication of 33.4 is obtained on the upper scale of the signal generator output meter.

(7) Set the MOD SELECTOR switch on the signal generator to the 400 cycle position and the METER READS switch on the signal generator to the % MOD position.

(8) Adjust the % MODULATION control on the signal generator until an indication of 30 is obtained on the lower scale of the signal generator output meter.

(9) Set the METER READS switch on the signal generator to the RF position.

(10) Rotate the BAND CHANGE switch on the signal generator until the indication 1.35 - 3.45 appears in the MEGACYCLES window.

(11) Rotate the radio receiver TUNING control until an indication of 1.35 megacycles is obtained on the main tuning and vernier dials multimeter. The indication on the multimeter should be between 2.3 and 2.6 volts.

(12) Rotate the CARRIER CONTROL on the signal generator fully counterclockwise and the MICROVOLTS control on the signal generator fully clockwise.

(13) Set the MOD SELECTOR switch on the signal generator to the OFF position.

(14) Rotate the signal generator tuning dial until an indication of 4.31 megacycles is obtained on the frequency and index scales.

(15) Adjust the CARRIER CONTROL on the signal generator until an indication of 100 is obtained on the signal generator output meter.

(16) Adjust the MICROVOLTS control on the signal generator until an indication of 20 is obtained on the upper scale of the signal generator output meter.

(17) Rotate the radio receiver TUNING control until an indication of 3.4 megacycles is obtained on the main tuning and vernier dials.

(18) Set the MOD SELECTOR switch on the signal generator to the 400 cycle position. The indication on the multimeter should be between 2.3 and 2.6 volts.

(19) Rotate the CARRIER CONTROL on the signal generator fully counterclockwise and the MICROVOLTS control on the signal generator fully clockwise.

(20) Set the MOD SELECTOR switch on the signal generator to the OFF position.

(21) Set the FREQUENCY BAND SWITCH on the signal generator to the Band G position.

(22) Rotate the signal generator tuning dial until an indication of 8.31 megacycles is obtained on the frequency and index scales.

(23) Set the MULTIPLIER switch on the signal generator signal to the 10 position and adjust the CARRIER CONTROL on the signal generator until an indication of 100 is obtained on the signal generator output meter.

(24) Adjust the MICROVOLTS control on the signal generator output meter until an

indication of 50 is obtained on the upper scale of the signal generator output meter.

(25) Rotate the BAND CHANGE switch on the radio receiver until the indication 7. 4 - 14. 8 appears in the MEGACYCLES window.

(26) Rotate the radio receiver TUNING control until an indication of 7. 4 megacycles is obtained on the main tuning and vernier dials.

(27) Set the MOD SELECTOR switch on the signal generator to the 400 cycle position. The indication on the multimeter should be between 2. 3 and 2. 6 volts.

(28) Rotate the CARRIER CONTROL on the signal generator fully counterclockwise and the MICROVOLTS control on the signal generator fully clockwise.

(29) Set the MOD SELECTOR switch on the signal generator to the OFF position.

(30) Set the FREQUENCY BAND SWITCH on the signal generator to the Band H position.

(31) Set the CARRIER RANGE switch on the signal generator to the H position.

(32) Rotate the signal generator tuning dial until an indication of 22. 41 megacycles is obtained on the frequency and index scales.

(33) Set the MULTIPLIER switch on the signal generator to the . 1 position and adjust the CARRIER CONTROL on the signal generator until an indication of 100 is obtained on the signal generator output meter.

(34) Adjust the MICROVOLTS control on the signal generator until an indication of 67 is obtained on the upper scale of the signal generator output meter.

(35) Rotate the radio receiver TUNING control until an indication of 14. 5 megacycles is obtained on the main tuning and vernier dials.

(36) Set the MOD SELECTOR switch on the signal generator to the 400 cycle position. The indication on the multimeter should be between 2. 3 and 2. 6 volts.

(37) Rotate the CARRIER CONTROL on the signal generator fully counterclockwise and the MICROVOLTS control on the signal generator fully clockwise.

(38) Set the MOD SELECTOR switch on the signal generator to the OFF position.

(39) Rotate the signal generator tuning dial until an indication of 37. 41 megacycles is obtained on the frequency and index scales.

(40) Set the MULTIPLIER switch on the signal generator to the 1 position and adjust the CARRIER CONTROL on the signal generator until an indication of 100 is obtained on the signal generator output meter.

(41) Adjust the MICROVOLTS control on the signal generator until an indication of 40 is obtained on the upper scale of the signal generator output meter.

(42) Rotate the BAND CHANGE switch on the radio receiver until the indication 14. 8 - 29. 7 appears in the MEGACYCLES window.

(43) Rotate the radio receiver TUNING control until an indication of 29. 5 megacycles is obtained on the main tuning and vernier dials.

(44) Set the MOD SELECTOR switch on the signal generator to the 400 cycle position. The indication on the multimeter should be between 2. 3 and 2. 6 volts.

(45) Rotate the RF GAIN control on the radio receiver counterclockwise to the OFF position.

c. Concluding Procedure

(1) Set the signal generator POWER ON-OFF switch to the OFF position and disconnect

the antenna test cable from the radio receiver equipment.

(2) Disconnect the power line plug of the signal generator from the power source.

(3) Disconnect the multimeter test leads from the radio receiver and the power line plug of the multimeter from the power source.

(4) Disconnect the power line plug of the radio receiver from the power source.

(5) Remove the 600-ohm resistor from the AUDIO OUTPUT terminals on the rear of the radio receiver.

(6) Replace the top cover on the radio receiver and tighten the four thumb screws.

(7) Replace the radio receiver in the relay rack and tighten the eight holding screws to secure the radio receiver.

(8) Connect all the cables and wires to their respective terminals on the rear of the radio receiver.

(9) Insert the power line plug of the radio receiver into a 115-volt, 60-cycle power source.

# PERFORMANCE TEST - RADIO RECEIVERS SP-600-JX-21 AND SP-600-JX-17, SENSITIVITY, AUDIO POWER, AND INTERMEDIATE-FREQUENCY OUTPUT

## 1. GENERAL INFORMATION

a. The purpose of this routine is to check the sensitivity, audio power, and intermediate-frequency voltage output of Radio Receiver SP-600-JX-21 or SP-600-JX-17.

b. The approximate time required to do this routine is 1-1/2 man-hours.

c. Report all indications that are not within tolerance to the maintenance supervisor for corrective action.

## 2. TEST EQUIPMENT REQUIRED

a. Signal Generator AN/URM-25

b. Electronic Multimeter TS-505( )/U

## 3. MATERIAL REQUIRED

a. Screwdriver

b. Soldering iron

c. Resistor 600-ohm, 2-watt, non-inductive

d. Resistors, 121-ohm, 1/2-watt, non-inductive, two

e. Resistor, 68-ohm, 1/2-watt, non-inductive

f. Black test lead

g. Two alligator clips

h. Two connector plugs PL-259

i. Connector plug UG-102/U

j. One 30-inch length of RG-22/U cable

k. Two 30-inch lengths of RG-59/U cable

l. Antenna test cable for Radio Receiver SP-600-JX-21 fabricated as follows:

(1) Remove 1-1/8 inches of outer insulation from both ends of the RG-22/U cable and cut the braid back 3/4 inch.

(2) Strip 5/8 inch of insulation from both conductors and tin the exposed conductors and braid.

(3) Disassemble the connector plug, UG-102/U, and slide the coupling ring on the cable. Screw the back shell to the cable, aligning the solder holes with the conductors.

(4) Assemble the front shell to the back shell so that both solder holes are in line.

(5) Solder the braid to the shells through the solder holes and solder the conductors to the contacts.

(6) Screw the coupling ring to the back shell.

(7) Strip 5/8 inch of insulation from the center conductors on the other end of the cable.

(8) Solder a 121-ohm, 1/2-watt resistor between the two conductors.

m. Antenna test cable for Radio Receiver SP-600-JX-17 fabricated as follows:

(1) Remove 1-1/8 inches of outer insulation from both ends of the RG-59/U cable and cut the braid back 3/4 inch.

(2) Strip 5/8 inch of insulation from the center conductor and tin the exposed conductor and braid.

(3) Disassemble the connector plug, PL-259, and slide the coupling ring on the cable. Screw the plug subassembly to the cable.

(4) Solder the braid to the assembly through the solder hole and solder the center conductor to the contact.

(5) Screw the coupling ring to the plug subassembly.

(6) Unravel the exposed braid at the other end of the cable and twist it to form a lead. Strip 5/8 inch of insulation from the center conductor and the braid.

(7) Solder a 121-ohm, 1/2-watt resistor between the center conductor and the braid.

n. Cathode follower cable for Radio Receiver SP-600-JX-21 or SP-600-JX-17 fabricated as follows:

(1) Repeat step m. (1) through (6).

(2) Solder the 68-ohm, 1/2-watt resistor between the center conductor and the braid.

4. PROCEDURE

a. Preliminary Procedure

(1) Disconnect the power line plug of the radio receiver from the power source.

(2) Disconnect the loudspeaker from the AUDIO OUTPUT terminals.

(3) Disconnect the antenna cable from the antenna input connector.

(4) Disconnect the BFO, IFO, DIODE OUTPUT and AVC connections from their respective terminals.

(5) Deleted

(6) Loosen the four thumb screws holding the top cover to the radio receiver and remove the cover.

(7) Insert the power line plug of the radio receiver into the 115-volt, 60-cycle power source.

(8) Connect the 600-ohm, 2-watt resistor between the AUDIO OUTPUT terminals on the rear of the radio receiver.

(9) Insert the power line plug of Electronic Multimeter TS-505( )/U into a 115-volt, 60-cycle power source.

(10) Connect the black test lead to the COMMON binding post on the multimeter.

(11) Connect an alligator clip to the other end of the black test lead and clip the lead to one side of the 600-ohm resistor connected across the AUDIO OUTPUT terminals on the rear of the radio receiver.

(12) Connect an alligator clip to the a-c probe of the multimeter and clip the probe to the other side of the 600-ohm resistor.

(13) Set the RANGE switch on the multimeter to the 40V/R x 10K position.

(14) Set the FUNCTION switch on the multimeter to the A. C. position and allow 3 minutes for the multimeter to warm up.

(15) Set up Signal Generator AN/URM-25( ) to deliver an unmodulated 2-megacycle r-f signal. Set up Signal Generator AN/URM-25 as follows:

(a) Insert the female plug of the power line into the socket on the lower left corner of the signal generator front panel.

(b) Insert the male plug of the power line into the 115-volt, 60-cycle power source.

(c) Rotate the CARRIER CONTROL and the % MODULATION control on the signal generator fully counterclockwise.

(d) Set the FREQUENCY BAND SWITCH on the signal generator to the Band F position.

(e) Set the CARRIER RANGE switch on the signal generator to the DEFG position.

(f) Rotate the signal generator tuning dial until an indication of 2 megacycles is obtained on the frequency and index scales.

(g) Set the MOD SELECTOR switch on the signal generator to the OFF position.

(h) Set the METER READS switch on the signal generator to the RF position.

(i) Set the POWER ON-OFF switch to the ON position and allow 15 minutes for the signal generator to warm up.

(16) Connect the antenna test cable to the antenna input connector of the radio receiver.

(17) Connect the antenna test cable to the signal generator as follows:

(a) Connect one end of the 121-ohm resistor to the center contact of the signal generator X MULT RF OUTPUT jack.

(b) Connect the other end of the 121-ohm resistor to ground terminal G.

(18) Set up Radio Receiver SP-600-JX-21 for the reception of an amplitude-modulated signal as follows:

(a) Set the SEND-REC switch to the REC position.

(b) Set the FREQ CONTROL switch to the VFO position.

(c) Set the LIMITER-OFF switch to the OFF position.

(d) Set the AVC-MAN switch to the AVC position.

(19) Set up Radio Receiver SP-600-JX-17 for the reception of an amplitude-modulated signal as follows:

(a) Set the SEND-REC switch to the REC position.

(b) Set the IFO switch to the INT position.

(c) Set the HFO switch to the VAR position.

(d) Set the LIMITER-OFF switch to the OFF position.

(e) Set the AVC-MAN switch to the AVC position.

b. Check the sensitivity of the radio receiver as follows:

(1) Rotate the RF GAIN control on the radio receiver clockwise from the OFF position to 0.

WARNING

Dangerous voltages are present in the unit under test. Observe all safety precautions.

(2) Set the MOD-CW switch on the radio receiver to the MOD position.

(3) If this check is being performed on Radio Receiver SP-600-JX-17 set the BFO-AVC switch to the INT BFO-FAST position.

(4) Rotate the MICROVOLTS control on the signal generator fully clockwise.

(5) Set the MULTIPLIER switch on the signal generator to the .1 position and adjust the CARRIER CONTROL until an indication of 100 is obtained on the signal generator output meter.

(6) Set the SELECTIVITY switch on the radio receiver to the 3 NON-XTAL position and adjust the MICROVOLTS control on the signal generator until an indication of 30 is obtained on the upper scale of the signal generator output meter.

(7) Set the MOD SELECTOR switch on the signal generator to the 400 cycle position.

(8) Set the METER READS switch on the signal generator to the % MOD position and adjust the % MODULATION control until an indication of 30 is obtained on the lower scale of the signal generator output meter.

(9) Set the METER READS switch on the signal generator to the RF position.

(10) Rotate the RF GAIN control on the radio receiver fully clockwise.

(11) Rotate the radio receiver TUNING control until an indication of 2 megacycles is obtained on the main tuning and vernier dials.

(12) Set the RANGE switch on the multimeter to the 4V/R x 10 position and adjust the AUDIO GAIN control on the radio receiver until an indication of 2.45 volts is obtained on the multimeter.

(13) Set the MOD SELECTOR switch on the signal generator to the OFF position.

(14) Set the RANGE switch on the multimeter to the 2V/R x 1 position and adjust the AUDIO GAIN control on the radio receiver until an indication of 0.6 volt is obtained on the multimeter.

(15) Set the MOD SELECTOR switch on the signal generator to the 400 cycle position and adjust the MICROVOLTS control on the signal generator until an indication of 1.9 volts is obtained on the multimeter. Observe the signal generator output meter. The indication on the upper scale should be 20 or less.

(16) Set the RANGE switch on the multimeter to the 4V/R x 10 position and adjust the AUDIO GAIN control on the radio receiver until an indication of 2.45 volts is obtained on the multimeter.

c. Check the audio power output of the radio receiver as follows:

WARNING

Dangerous voltages are present in the unit under test. Observe all safety precautions.

(1) If this check is being performed on Radio Receiver SP-600-JX-17 set the BFO-AVC

switch to the INT BFO - FAST position.

(2) Rotate the signal generator MICROVOLTS control fully clockwise.

(3) Set the MULTIPLIER switch on the signal generator to the .1 position and adjust the CARRIER CONTROL on the signal generator until an indication of 100 is obtained on the signal generator output meter.

(4) Set the SELECTIVITY switch on the radio receiver to the 3 NON-XTALS position and adjust the signal generator MICROVOLTS control until an indication of 30 is obtained on the upper scale of the signal generator output meter.

(5) Set the MOD SELECTOR switch on the signal generator to the 400 cycle position and the METER READS switch on the signal generator to the % MOD position.

(6) Adjust the % MODULATION control on the signal generator until an indication of 30 is obtained on the lower scale of the signal generator output meter.

(7) Set the METER READS switch on the signal generator to the RF position.

(8) Rotate the BAND CHANGE switch on the radio receiver until the indication 1.35-3.45 appears in the MEGACYCLES window.

(9) Rotate the radio receiver TUNING control until an indication of 2.0 megacycles is obtained on the main tuning and vernier dials.

(10) Rotate the AUDIO GAIN control on the radio receiver fully clockwise. The indication on the multimeter should be between 33 and 36 volts.

(11) Rotate the RF GAIN control on the radio receiver counterclockwise to the OFF position.

d. Check the intermediate-frequency output voltage of the radio receiver as follows:

(1) Connect the cathode follower cable to the I-F OUTPUT connector located on the rear of the radio receiver chassis.

(2) Disconnect the test lead and a-c probe from the 600-ohm resistor.

(3) Clip the black test lead to the braid of the cathode follower cable and the a-c probe to the other side of the 68-ohm resistor.

(4) Set the multimeter RANGE switch to the 2V/R x 1 position.

(5) Rotate the RF GAIN control on the radio receiver fully clockwise. The indication on the multimeter should exceed 0.2 volt.

(6) Rotate the RF GAIN control on the radio receiver counterclockwise to the OFF position.

e. Concluding Procedure

(1) Set the signal generator POWER ON-OFF switch to the OFF position.

(2) Disconnect the antenna test cable from the radio receiver.

(3) Disconnect the power line plug of the signal generator from the power source.

(4) Disconnect the multimeter test leads from the cathode follower cable.

(5) Disconnect the multimeter power line cord plug from the 115-volt, 60-cycle power source.

(6) Disconnect the cathode follower from the I-F OUTPUT connector.

(7) Disconnect the power line plug of the radio receiver from the power source.

(8) Remove the 600-ohm resistor from the AUDIO OUTPUT terminals on the rear of the radio receiver.

(9) Replace the top cover of the radio receiver and tighten the four thumb screws.

(10) Replace the radio receiver in the rack and tighten the eight holding screws to secure the radio receiver.

(11) Connect all the cables and wires to their respective terminals on the rear of the radio receiver.

(12) Insert the power line plug of the radio receiver into the 115-volt, 60-cycle power source.

# PERFORMANCE TEST - RADIO RECEIVERS SP-600-JX-21 AND SP-600-JX-17, HETERODYNE INTERFERENCE CHECK

## 1. GENERAL INFORMATION

a. The purpose of this routine is to check the heterodyne interference of Radio Receiver SP-600-JX-21 or SP-600-JX-17.

b. The approximate time required to do this routine is 1 man-hour.

c. Report all measurements that are not within tolerance to the maintenance supervisor for corrective action.

## 2. TEST EQUIPMENT REQUIRED

a. Signal Generator AN/URM-25

## 3. MATERIAL REQUIRED

a. Screwdriver

b. Soldering iron

c. Resistor, 600-ohm, 2-watt, non-inductive

d. Resistors, 121-ohm, 1/2-watt, non-inductive, two

e. Headset HS-33

f. Connector plug PL-259

g. Connector plug UG-102/U

h. One 30-inch length of RG-22/U cable

i. One 30-inch length of RG-59/U cable

j. Antenna test cable for Radio Receiver SP-600-JX-21 fabricated as follows:

(1) Remove 1-1/8 inches of outer insulation from both ends of the RG-22/U cable and cut the braid back 3/4 inch.

(2) Strip 5/8 inch of insulation from both conductors and tin the exposed conductors and braid.

(3) Disassemble the connector plug, UG-102/U, and slide the coupling ring on the cable. Screw the back shell to the cable, aligning the solder hole with the conductors.

(4) Assemble the front shell to the back shell so that both solder holes are in line.

(5) Solder the braid to the shells through the solder holes and solder the conductors to the contacts.

(6) Screw the coupling ring to the back shell.

(7) Strip 5/8 inch of insulation from the center conductors on the other end of the cable.

(8) Solder a 121-ohm, 1/2-watt resistor between the two conductors.

k. Antenna test cable for Radio Receiver SP-600-JX-17 fabricated as follows:

(1) Remove 1-1/8 inches of outer insulation from both ends of the RG-59/U cable and cut the braid back 3/4 inch.

(2) Strip 5/8 inch of insulation from the center conductor and tin the exposed conductor and braid.

(3) Disassemble the connector plug, PL-259, and slide the coupling on the cable. Screw the plug subassembly to the cable.

(4) Solder the braid to the assembly through the solder hole and solder the center conductor to the contact.

(5) Screw the coupling ring to the plug subassembly.

(6) Unravel the exposed braid at the other end of the cable and twist it to form a lead. Strip 5/8 inch of insulation from the center conductor.

(7) Solder a 121-ohm, 1/2-watt resistor between the center conductor and the braid.

4. PROCEDURE

a. Preliminary Procedure

(1) Disconnect the power line plug of the radio receiver from the power source.

(2) Disconnect the loudspeaker from the AUDIO OUTPUT terminals.

(3) Disconnect the BFO, IFO, RF, GND, DIODE OUTPUT, and AVC connections from their respective terminals.

(4) Disconnect the antenna cable from the antenna input connector.

(5) Remove the eight screws holding the radio receiver in the relay rack and remove the radio receiver from the rack.

(6) Loosen the four thumb screws holding the top cover to the radio receiver and remove the cover.

(7) Insert the power line plug of the radio receiver into a 115-volt, 60-cycle power source.

(8) Connect the 600-ohm, 2-watt resistor between the AUDIO OUTPUT terminals on the rear of the radio receiver.

(9) Set up Signal Generator AN/URM-25( ) to deliver an unmodulated 2-megacycle r-f signal. Set up Signal Generator AN/URM-25 as follows:

(a) Insert the female plug of the power line into the socket on the lower left corner of the signal generator front panel.

(b) Insert the male plug of the power line into a 115-volt, 60-cycle power source.

(c) Rotate the CARRIER CONTROL on the signal generator and the % MODULATION control on the signal generator fully counterclockwise.

(d) Set the FREQUENCY BAND SWITCH on the signal generator to the Band F position.

(e) Set the CARRIER RANGE switch on the signal generator to the DEFG position.

(f) Rotate the signal generator dial until an indication of 2 megacycles is obtained on the frequency and index scales.

(g) Set the MOD SELECTOR switch on the signal generator to the OFF position.

(h) Set the METER READS switch on the signal generator to the RF position.

(i) Set the POWER ON-OFF switch on the signal generator to the ON position and allow 15 minutes for the signal generator to warm up.

(9) Connect the antenna test cable to the antenna input connector of the receiver.

(10) Connect the antenna test cable to the signal generator as follows:

(a) Connect one end of the 121-ohm resistor to the center contact of the signal generator X MULT RF OUTPUT jack.

(b) Connect the other end of the 121-ohm resistor to ground terminal G.

(11) Set up Radio Receiver SP-600-JX-21 for the reception of a continuous-wave signal as follows:

(a) Set the SEND-REC switch to the REC position.

(b) Set the FREQ CONTROL switch to the VFO position.

(c) Set the LIMITER-OFF switch to the OFF position.

(d) Set the AVC-MAN switch to the MAN position.

(12) Set up Radio Receiver SP-600-JX-17 for the reception of a continuous-wave signal as follows:

(a) Set the SEND-REC switch to the REC position.

(b) Set the IFO switch to the INT position.

(c) Set the HFO switch to the VAR position.

(d) Set the LIMITER-OFF switch to the OFF position.

(e) Set the AVC-MAN switch to the MAN position.

b. Check the heterodyne interference of the radio receiver as follows:

(1) Set the BEAT OSC control on the radio receiver to the 0 position, and plug Headset HS-33 into the PHONES jack.

(2) Rotate the RF GAIN control on the radio receiver fully clockwise.

WARNING

Dangerous voltages are present in the unit under test. Observe all safety precautions.

(3) Set the MOD-CW switch on the radio receiver to the CW position.

(4) If this check is being performed on Radio Receiver SP-600-JX-17 set the BFO-AVC switch to the INT BFO - FAST position.

(5) Rotate the signal generator MICROVOLTS control fully clockwise.

(6) Set the MULTIPLIER switch on the signal generator to the . 1 position and adjust the CARRIER CONTROL on the signal generator until an indication of 100 is obtained on the signal generator output meter.

(7) Set the SELECTIVITY switch on the radio receiver to the 3 NON-XTAL position and adjust the signal generator MICROVOLTS control until an indication of 20 is obtained on the upper scale of the signal generator output meter.

(8) Rotate the BAND CHANGE switch on the radio receiver until the indication 1. 35-

3. 45 appears in the MEGACYCLES window.

(9) Rotate the radio receiver TUNING control until an indication of 2 megacycles is obtained on the main tuning and vernier disk.

(10) Rotate the BEAT OSC control on the radio receiver to the 1. 0 KC MINUS position and check that a tone can be heard in the headset. Rotate the BEAT OSC control to the 1. 0 KC PLUS position and check that a tone can be heard in the headset.

(11) Set the AVC-MAN switch on the radio receiver to the AVC position and the SELECTIVITY switch on the radio receiver to the 1. 3 XTAL position.

(12) Vary the signal generator tuning dial within 1. 3 kilocycles above the 2-megacycle position until a distorted tone is heard in the headset. Check that the XTAL PHASING control on the radio receiver can eliminate the distortion in the tone heard in the headset.

(13) Vary the signal generator tuning dial within 1. 3 kilocycles below the 2-megacycle position until a distorted tone is heard in the headset. Check that the XTAL PHASING control on the radio receiver can eliminate the distortion in the tone heard in the headset.

c. Concluding Procedure

(1) Rotate the RF GAIN control on the radio receiver counterclockwise to the OFF position.

(2) Set the signal generator POWER ON-OFF switch to the OFF position and disconnect the antenna test cable from the radio receiver.

(3) Disconnect the power line plug of the signal generator from the power source.

(4) Disconnect the power line plug of the radio receiver from the power source.

(5) Remove the 600-ohm resistor from the AUDIO OUTPUT terminals on the rear of the radio receiver.

(6) Replace the top cover of the radio receiver and tighten the four thumb screws.

(7) Replace the radio receiver in the rack and tighten the eight holding screws to secure the radio receiver.

(8) Connect all the cables and wires to their respective terminals on the rear of the radio receiver.

(9) Insert the power line plug of the radio receiver into the 115-volt, 60-cycle power source.

# PERFORMANCE TEST - RADIO RECEIVERS SP-600-JX-21 AND SP-600-JX-17, AUTOMATIC VOLUME CONTROL ACTION

## 1. GENERAL INFORMATION

a. The purpose of this routine is to check the action of the automatic volume control circuit of Radio Receiver SP-600-JX-21 or SP-600-JX-17.

b. The approximate time required to do this routine is 1 man-hour.

c. Report all indications that are not within tolerance to the maintenance supervisor for corrective action.

## 2. TEST EQUIPMENT REQUIRED

a. Signal Generator AN/URM-25

b. Electronic Multimeter TS-505( )/U

## 3. MATERIALS REQUIRED

a. Screwdriver

b. Soldering iron

c. Resistor, 600-ohm, 2-watt, non-inductive

d. Resistors, 121-ohm, 1/2-watt, non-inductive, two

e. Black test lead

f. Two alligator clips

g. Connector plug PL-259

h. Connector plug UG-102/U

i. One 30-inch length of RG-22/U cable

j. One 30-inch length of RG-59/U cable

k. Headset HS-33

l. Antenna test cable for Radio Receiver SP-600-JX-21 fabricated as follows:

(1) Remove 1-1/8 inches of outer insulation from both ends of the RG-22/U cable and cut the braid back 3/4 inch.

(2) Strip 5/8 inch of insulation from both conductors and tin the exposed conductors and braid.

(3) Disassemble the connector plug, UG-102/U, and slide the coupling ring on the cable. Screw the back shell to the cable, aligning the solder hole with the conductors.

(4) Assemble the front shell to the back shell so that both solder holes are in line.

(5) Solder the braid to the shells through the solder holes and solder the conductors to the contacts.

(6) Screw the coupling ring to the back shell.

(7) Strip 5/8 inch of insulation from the center conductors on the other end of the cable.

(8) Solder a 121-ohm, 1/2-watt resistor between the two conductors.

m. Antenna test cable for Radio Receiver SP-600-JX-17 fabricated as follows:

(1) Remove 1-1/8 inches of outer insulation from both ends of the RG-59/U cable and cut the braid back 3/4 inch.

(2) Strip 5/8 inch of insulation from the center conductor and tin the exposed conductor and braid.

(3) Disassemble the connector plug, PL-259, and slide the coupling ring on the cable. Screw the plug subassembly on the cable.

(4) Solder the braid to the assembly through the solder hole and solder the center conductor to the contact.

(5) Screw the coupling ring to the plug subassembly.

(6) Unravel the exposed braid at the other end of the cable and twist it to form a lead. Strip 5/8 inch of insulation from the center conductor.

(7) Solder a 121-ohm, 1/2-watt resistor between the center conductor and the braid.

4. PROCEDURE

a. Preliminary Procedure

(1) Disconnect the power line plug of the radio receiver from the power source.

(2) Disconnect the loudspeaker from the AUDIO OUTPUT terminals.

(3) Disconnect the BFO, IFO, DIODE OUTPUT and AVC connections from their respective terminals.

(4) Disconnect the antenna cable from the antenna input connector.

(5) Remove the eight screws holding the radio receiver in the relay rack and remove the receiver from the rack.

(6) Loosen the four thumb screws holding the top cover to the radio receiver and remove the cover.

(7) Insert the power line plug of the radio receiver into a 115-volt, 60-cycle power source.

(8) Connect the 600-ohm, 2-watt resistor between the AUDIO OUTPUT terminals on the rear of the radio receiver.

(9) Insert the power line plug of Electronic Multimeter TS-505( )/U into a 115-volt, 60-cycle power source.

(10) Connect the black test lead to the COMMON binding post on the multimeter.

(11) Connect an alligator clip to the other end of the black test lead and clip the lead to one side of the 600-ohm resistor connected across the AUDIO OUTPUT terminals on the rear of the radio receiver.

(12) Connect an alligator clip to the a-c probe of the multimeter and clip the probe to the other side of the 600-ohm resistor.

(13) Set the RANGE switch on the multimeter to the 4V/R x 10 position.

(14) Set the FUNCTION switch on the multimeter to the A. C. position and allow 3 minutes for the multimeter to warm up.

(15) Set up Signal Generator AN/URM-25( ) to deliver an unmodulated 2-megacycle r-f signal. Set up Signal Generator AN/URM-25 as follows:

(a) Insert the female plug of the power line into the socket on the lower left corner of the radio receiver front panel.

(b) Insert the male plug of the power line into a 115-volt, 60-cycle power source.

(c) Rotate the CARRIER CONTROL on the signal generator and the % MODULATION control on the signal generator counterclockwise.

(d) Set the FREQUENCY BAND SWITCH on the signal generator to the Band F position.

(e) Set the CARRIER RANGE switch on the signal generator to the DEFG position.

(f) Rotate the signal generator tuning dial until an indication of 2 megacycles is obtained on the frequency and index scales.

(g) Set the MOD SELECTOR switch on the signal generator to the OFF position.

(h) Set the METER READS switch on the signal generator to the RF position.

(i) Set the POWER ON-OFF switch to the ON position and allow 15 minutes for the signal generator to warm up.

(16) Connect the antenna test cable to the antenna input connector of the receiver.

(17) Connect the antenna test cable to the signal generator as follows:

(a) Connect one end of the 121-ohm resistor to the center contact of the signal generator X MULT RF OUTPUT jack.

(b) Connect the other end of the 121-ohm resistor to ground terminal G.

(18) Set up Radio Receiver SP-600-JX-21 for the reception of an amplitude-modulated signal as follows:

(a) Set the SEND-REC switch to the REC position.

(b) Set the FREQ CONTROL switch to the VFO position.

(c) Set the LIMITER-OFF switch to the OFF position.

(d) Set the AVC-MAN switch to the AVC position.

(19) Set up Radio Receiver SP-600-JX-17 for the reception of an amplitude-modulated signal as follows:

(a) Set the SEND-REC switch to the REC position.

(b) Set the IFO switch to the INT position.

(c) Set the HPO switch to the VAR position.

(d) Set the LIMITER-OFF switch to the OFF position.

(e) Set the AVC-MAN switch to the AVC position.

b. Check the operation of the radio receiver automatic volume control circuit as follows:

(1) Rotate the RF GAIN control on the radio receiver fully clockwise.

WARNING

Dangerous voltages are present in the unit under test. Observe all safety precautions.

(2) Rotate the AUDIO GAIN control on the radio receiver fully counterclockwise.

(3) Set the MOD-CW switch on the radio receiver to the MOD position.

(4) If this check is being performed on Radio Receiver SP-600-JX-17 set the BFO-AVC switch to the INT BFO - FAST position.

(5) Rotate the signal generator MICROVOLTS control fully clockwise.

(6) Set the MULTIPLIER switch on the signal generator to the . 1 position and adjust the CARRIER CONTROL on the signal generator until an indication of 100 is obtained on the signal generator output meter.

(7) Set the SELECTIVITY switch on the radio receiver to the 3 NON-XTAL position and adjust the signal generator MICROVOLTS control until an indication of 20 is obtained on the upper scale of the signal generator output meter.

(8) Set the MOD SELECTOR switch on the signal generator to the 400 cycle position and the METER READS switch on the signal generator to the % MOD position.

(9) Adjust the % MODULATION control on the signal generator until an indication of 30 is obtained on the lower scale of the signal generator output meter.

(10) Set the METER READS switch on the signal generator to the RF position.

(11) Rotate the BAND CHANGE switch on the radio receiver until the indication 1. 35-3. 45 appears in the MEGACYCLES window.

(12) Rotate the radio receiver TUNING control until an indication of 2 megacycles is obtained on the main tuning and vernier dials.

(13) Adjust the AUDIO GAIN control on the radio receiver until an indication of 2. 54 volts is obtained on the multimeter.

(14) Rotate the signal generator MICROVOLTS control clockwise. The indication on the multimeter should be between 2. 5 and 3. 8 volts. Rotate the MICROVOLTS control fully counterclockwise.

(15) Set the MULTIPLIER switch to the 1 position and repeat step (14).

(16) Set the MULTIPLIER switch to the 10 position and repeat step (14).

(17) Set the MULTIPLIER switch to the 100 position and repeat step (14).

(18) Set the MULTIPLIER switch to the 1000 position and repeat step (14).

c. Concluding Procedure

(1) Rotate the RF GAIN control on the radio receiver counterclockwise to the OFF position.

(2) Set the signal generator POWER ON-OFF switch to the OFF position and disconnect the antenna test cable from the radio receiver.

(3) Disconnect the power line plug of the signal generator from the power source.

(4) Disconnect the multimeter test leads from the radio receiver and disconnect the multimeter power line plug from the power source.

(5) Disconnect the power line plug of the radio receiver from the power source.

(6) Remove the 600-ohm resistor from the AUDIO OUTPUT terminals on the rear of the radio receiver.

(7) Replace the top cover of the radio receiver and tighten the four thumb screws.

(8) Replace the radio receiver in the rack and tighten the eight holding screws to secure the radio receiver.

(9) Connect all the cables and wires to their respective terminals on the rear of the radio receiver.

(10) Insert the power line plug of the radio receiver into the 115-volt, 60-cycle power source.

SERVICING - RADIO RECEIVERS SP-600-JX-21 AND SP-600-JX-17,
OPERATING INSTRUCTIONS

1. GENERAL INFORMATION

a. The purpose of this routine is to outline procedures for placing Radio Receiver SP-600-JX-21 or SP-600-JX-17 in the desired mode of operation.

b. The approximate time required to do this routine is 20 minutes.

2. TEST EQUIPMENT REQUIRED

a. None

3. MATERIALS REQUIRED

a. Headset HS-33

4. PROCEDURE

a. Set up Radio Receiver SP-600-JX-21 for the reception of an amplitude-modulated signal as follows:

(1) Set the SEND-REC switch to the REC position.

(2) Set the FREQ CONTROL switch to the VFO position.

(3) Set the LIMITER-OFF switch to the OFF position.

(4) Set the AVC-MAN switch to the AVC position.

(5) Set the XTAL PHASING control to the position indicated by the diamond between settings 4 and 6.

b. Set up Radio Receiver SP-600-JX-17 for the reception of an amplitude-modulated signal as follows:

(1) Set the SEND-REC switch to the REC position.

(2) Set the IFO switch to the INT position.

(3) Set the HFO switch to the VAR position.

(4) Set the LIMITER-OFF switch to the OFF position.

(5) Set the AVC-MAN switch to the AVC position.

(6) Set the XTAL PHASING control to the position indicated by the diamond between settings 4 and 6.

c. Operate the radio receiver for reception of modulated, continuous-wave signals, either phone, signal-tone, or telegraph as follows:

(1) Plug Headset HS-33 into the PHONES jack.

(2) Rotate the RF GAIN control fully clockwise. Observe that the main tuning and vernier dials are illuminated by the panel lamps. Allow 15 minutes for the radio receiver to reach operating temperature.

(3) Unclamp the TUNING LOCK by turning it counterclockwise.

(4) Set the MOD-CW switch to the MOD position.

(5) If Radio Receiver SP-600-JX-17 is being operated, set the BFO-AVC switch to the INT BFO - FAST position.

(6) Rotate the AUDIO GAIN control until a tone is heard in the headset.

(7) Rotate the BAND CHANGE switch until the desired frequency range is observed through the MEGACYCLES window.

(8) Rotate the TUNING control until the desired frequency is obtained on the main tuning and vernier dials.

d. Operate the radio receiver for reception of modulated, continuous-wave (variable-frequency) signals as follows:

(1) Repeat steps a. and c. for Radio Receiver SP-600-JX-21.

(2) Repeat steps b. and c. for Radio Receiver SP-600-JX-17.

(3) Rotate the TUNING control until the desired frequency is obtained on the dials. A maximum indication should be obtained on the radio receiver output meter.

(4) Readjust the AUDIO GAIN control until a satisfactory audio level is obtained in the headset.

e. Operate the radio receiver for reception of modulated continuous-wave (crystal-controlled) signals as follows:

(1) Repeat steps a. and c. for Radio Receiver SP-600-JX-21.

(2) Repeat steps b. and c. for Radio Receiver SP-600-JX-17.

(3) Set the XTAL switch to the desired crystal position.

(4) Rotate the HFO-FREQ control until a maximum indication is obtained on the radio receiver output meter.

(5) Rotate the TUNING control until a maximum indication is obtained on the radio receiver output meter.

(6) Readjust the AUDIO GAIN control until a satisfactory audio level is obtained in the headset.

f. Operate the radio receiver for reception of continuous-wave signals as follows:

(1) For Radio Receiver SP-600-JX-21 repeat steps a. and c. with the exception of c. (4). The MOD-CW switch is to be set in the CW position.

(a) Rotate the BEAT OSC control to the 0 position.

(2) For Radio Receiver SP-600-JX-17 repeat steps b. and c. with the exception of c. (4). The MOD-CW switch is to be set in the CW position.

(a) Rotate the BEAT OSC control to the 0 position.

g. Operate the radio receiver for reception of continuous-wave (variable-frequency) signals as follows:

(1) For Radio Receiver SP-600-JX-21 repeat steps a. and c. with the exception of c(4). The MOD-CW switch is to be set in the CW position.

(2) For Radio Receiver SP-600-JX-17 repeat steps b. and c. with the exception of c(4). The MOD-CW switch is to be set in the CW position.

(3) Rotate the TUNING control until a maximum indication is obtained on the radio receiver output meter or a condition of zero beat is heard in the headset.

(4) Rotate the BEAT OSC control to approximately the 1. 0 position on the dial, this control should be set in the position that will provide the clearest reception.

(5) Readjust the RF GAIN control and AUDIO GAIN control until a satisfactory audio level is obtained in the headset.

h. Operate the radio receiver for reception of continuous-wave (crystal-controlled) signals as follows:

(1) For Radio Receiver SP-600-JX-21 repeat steps a. and c. with the exception of c(4). The MOD-CW switch is to be set in the CW position.

(2) For Radio Receiver SP-600-JX-17 repeat steps b. and c. with the exception of c(4). The MOD-CW switch is to be set in the CW position.

(3) Set the XTAL switch to the desired crystal position.

(4) Rotate the HFO-FREQ control until a maximum indication is obtained on the radio receiver output meter.

(5) Rotate the TUNING control until a maximum indication is obtained on the radio receiver output meter.

(6) Rotate the BEAT OSC control to approximately the 1. 0 position on the dial. This control should be set in the position that will provide the clearest reception.

(7) Readjust the RF GAIN control and AUDIO GAIN control until a satisfactory audio level is obtained in the headset.

i. Operate the radio receiver for reception of frequency-shift (teletype) signals as follows:

(1) For Radio Receiver SP-600-JX-21 repeat steps a. and c. with the exception of c(4). The MOD-CW switch is to be set in the CW position.

(2) For Radio Receiver SP-600-JX-17 repeat steps b. and c. with the exception of c(4). The MOD-CW switch is to be set in the CW position.

(3) Set the BEAT OSC control to the 0 position.

j. Operate the radio receiver for reception of frequency-shift (variable-frequency) signals as follows:

(1) For Radio Receiver SP-600-JX-21 repeat steps a. and c. with the exception of c(4). The MOD-CW switch is to be set in the CW position.

(2) For Radio Receiver SP-600-JX-17 repeat steps a. and c. with the exception of c(4). The MOD-CW switch is to be set in the CW position.

(3) Rotate the TUNING control until a tone output is obtained in the headset and a maximum indication is obtained on the radio receiver output meter.

(4) Rotate the BEAT OSC control until at approximately the ±2. 5 position on the dial a two-tone signal output is obtained from the headset.

k. Operate the radio receiver for reception of frequency-shift (crystal-controlled) signals as follows:

(1) For Radio Receiver SP-600-JX-21 repeat steps a. and c. with the exception of c(4). The MOD-CW switch is to be set in the CW position.

(2) For Radio Receiver SP-600-JX-17 repeat steps b. and c. with the exception of c(4). The MOD-CW switch is to be set in the CW position.

(3) Set the XTAL switch to the desired crystal position.

(4) Rotate the HFO-FREQ control until a maximum indication is obtained on the radio receiver output meter.

(5) Rotate the TUNING control until a maximum indication is obtained on the radio receiver output meter.

(6) Rotate the BEAT OSC control until at approximately the ±2. 5 position on the dial a two-tone signal output is obtained from the headset.

(7) Readjust the RF GAIN control and AUDIO GAIN control until a satisfactory audio level is obtained.

l. Operate the radio receiver for reception of supressed carrier phone, telegraph, and teletype signals as follows:

(1) Repeat steps a. and c. for Radio Receiver SP-600-JX-21.

(2) Repeat steps b. and c. for Radio Receiver SP-600-JX-17.

(3) Set the SELECTIVITY switch to the desired position determined by the mode of operation of the radio receiver.

m. Operate the radio receiver for reception of suppressed carrier (variable-frequency) signals as follows:

(1) Repeat steps a. and c. for Radio Receiver SP-600-JX-21.

(2) Repeat steps b. and c. for Radio Receiver SO-600-JX-17.

(3) Rotate the TUNING control on the radio receiver until a maximum indication is obtained on the output meter.

(4) Set the SELECTIVITY switch to the desired position determined by the mode of operation of the radio receiver.

(5) Adjust the AUDIO GAIN control until a satisfactory audio level is obtained in the headset.

n. Rotate the RF GAIN control counterclockwise to the OFF position.

SERVICING - RADIO RECEIVERS SP-600-JX-21 AND SP-600-JX-17, ALIGNMENT

1. GENERAL INFORMATION

a. The purpose of this routine is to align the intermediate-frequency and radio-frequency sections of Radio Receiver SP-600-JX-21 or SP-600-JX-17.

b. The approximate time required to do this routine is 8 man-hours.

2. TEST EQUIPMENT REQUIRED

a. Signal Generator AN/URM-25

b. Electronic Multimeter TS-505( )/U

3. MATERIAL REQUIRED

a. Screwdriver

b. Soldering iron

c. Resistor, 600-ohm, 2-watt, non-inductive

d. Resistors, 121-ohm, 1/2-watt, non-inductive, two

e. Black test lead

f. Two alligator clips

g. Connector plug PL-259

h. Connector plug UG-102/U

i. One 30-inch length of RG-22/U cable

j. One 30-inch length of RG-59/U cable

k. Test adapter, 7-pin-tube-socket

l. Alignment tool, insulated

m. Antenna test cable for Radio Receiver SP-600-JX-21 fabricated as follows:

(1) Remove 1-1/8 inches of outer insulation from both ends of the RG-22/U cable and cut the braid back 3/4 inch.

(2) Strip 5/8 inch of insulation from both conductors and tin the exposed conductors and braid.

(3) Disassemble the connector plug, UG-102/U, and slide the coupling ring on the cable. Screw the back shell to the cable, alignming the solder hole with the conductors.

(4) Assemble the front shell to the back shell so that both solder holes are in line.

(5) Solder the braid to the shells through the solder holes and solder the conductors to the contacts.

(6) Screw the coupling ring to the back shell.

(7) Strip 5/8 inch of insulation from the center conductors on the other end of the cable.

(8) Solder a 121-ohm, 1/2-watt resistor between the two conductors.

n. Antenna test cable for Radio Receiver SP-600-JX-17 fabricated as follows:

(1) Remove 1-1/8 inches of outer insulation from both ends of the RG-59/U cable and cut the braid back 3/4 inch.

(2) Strip 5/8 inch of insulation from the center conductor and tin the exposed conductor and braid.

(3) Disassemble the connector plug, PL-259, and slide the coupling ring on the cable. Screw the plug subassembly on the cable,

(4) Solder the braid to the assembly through the solder hole and solder the center conductor to the contact.

(5) Screw the coupling ring to the plug subassembly.

(6) Unravel the exposed braid at the other end of the cable and twist it to form a lead. Strip 5/8 inch of insulation from the center conductor.

(7) Solder a 121-ohm, 1/2-watt resistor between the center conductor and the braid.

4. PROCEDURE

a. Preliminary Procedure

(1) Disconnect the power line plug of the radio receiver from the power source.

(2) Disconnect the loudspeaker from the AUDIO OUTPUT terminals.

(3) Disconnect the antenna cable from the antenna input connector.

(4) Disconnect the BFO, IFO, DIODE OUTPUT, and AVC connections from their respective terminals.

(5) Remove the eight screws holding the radio receiver in the relay rack and remove the receiver from the rack.

(6) Loosen the four thumb screws holding the top cover to the radio receiver and remove the cover.

(7) Connect the 600-ohm, 2-watt resistor between the AUDIO OUTPUT terminals on the rear of the radio receiver.

(8) Remove the shield from tube V-5 (figure 2-1) and remove the tube.

(9) Plug tube V-5 into the tube socket test adapter and plug the adapter into the tube socket on the radio receiver.

(10) Insert the power line plug of the radio receiver into a 115-volt, 60-cycle power source.

(11) Insert the power line plug of Electronic Multimeter TS-505( )/A into a 115-volt, 60-cycle power source.

(12) Connect the black test lead to the COMMON binding post of the multimeter.

(13) Connect an alligator clip to the other end of the black test lead and clip the lead to one side of the 600-ohm resistor connected between the AUDIO OUTPUT terminals on the rear of the radio receiver.

(14) Connect an alligator clip to the a-c probe of the multimeter and clip the probe to the other side of the 600-ohm resistor.

(15) Set the RANGE switch on the multimeter to the 40V/R x 10K position.

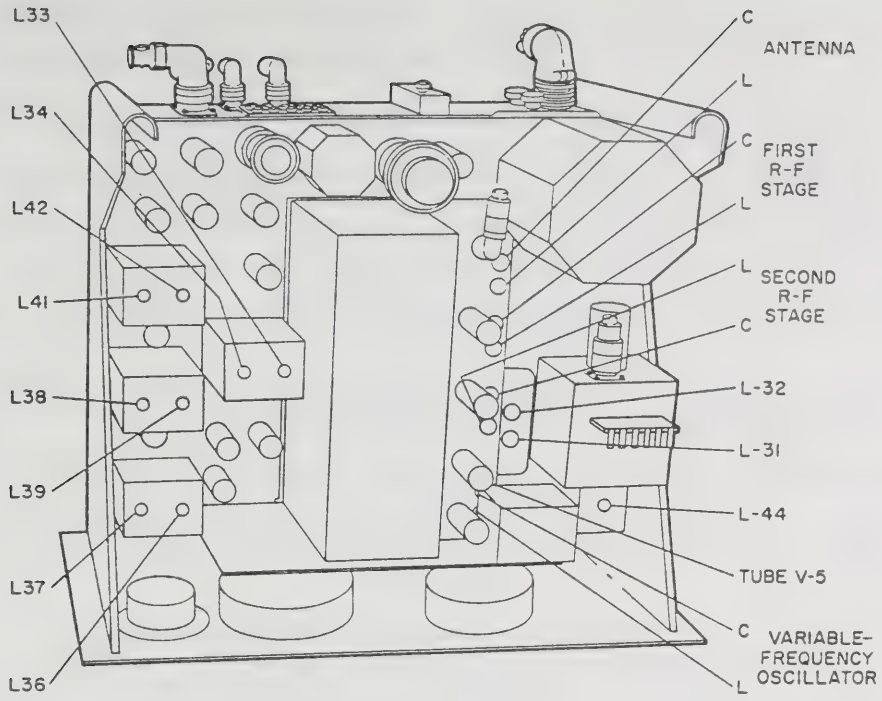


Figure 2-1. Radio Receiver SP-600-JX-17, Top View

(16) Set the FUNCTION switch on the multimeter to the A. C. position and allow 3 minutes for the multimeter to warm up.

(17) Set up Signal Generator AN/URM-25( ) to deliver an unmodulated 0. 455-megacycle r-f signal to pin 7 of tube V5 on the radio receiver. Set up Signal Generator AN/URM-25 as follows:

(a) Insert the female plug of the power line into the socket on the lower left corner of the signal generator front panel.

(b) Insert the male plug of the power line into a 115-volt, 60-cycle power source.

(c) Connect one end of the cable, W-105, to the signal generator X MULT RF OUTPUT jack and the other end of the cable to the test lead, CX-1363/U.

(d) Connect the black test lead of CX-1363/U to the radio receiver chassis (ground) and the red test lead of CX-1363/U to pin 7 of tube V-5.

(e) Rotate the CARRIER CONTROL and the % MODULATION control on the signal generator fully counterclockwise.

(f) Set the FREQUENCY BAND SWITCH on the signal generator to the Band D position.

(g) Set the CARRIER RANGE switch on the signal generator to the DEFG position.

(h) Rotate the signal generator tuning dial until an indication of 0. 455 megacycle is obtained on the frequency and index scales.

(i) Set the MOD SELECTOR switch on the signal generator to the OFF position.

(j) Set the METER READS switch on the signal generator to the RF position.

(k) Set the POWER ON-OFF switch on the signal generator to the ON position and allow 15 minutes for the signal generator to warm up.

b. Align the i-f stages of the radio receiver as follows:

(1) Set the SEND-REC switch on the radio receiver to the REC position.

(2) Set the MOD-CW switch on the radio receiver to the MOD position.

(3) Set the AVC-MAN switch on the radio receiver to the MAN position.

(4) Set the SELECTIVITY switch on the radio receiver to the 3 NON-XTAL position.

(5) Set the LIMITER-OFF switch on the radio receiver to the OFF position.

(6) Set the XTAL PHASING control on the radio receiver to the position indicated by the diamond between the settings 4 and 6.

(7) Rotate the BAND CHANGE switch on the radio receiver until the indication 1. 35-3. 45 appears in the MEGACYCLES window.

(8) Rotate the radio receiver TUNING control until an indication of 2. 5 megacycles is obtained on the main tuning and vernier dials.

(9) Rotate the AUDIO GAIN control on the radio receiver fully clockwise.

(10) Rotate the RF GAIN control on the radio receiver fully clockwise.

NOTE

In each of the following steps where alignment adjustments are to be made, the indicator on the multimeter should first be set to the midpoint of the scale. This is done by rotating the RF GAIN control. This procedure will assure accurate adjustments.

(11) Set the MULTIPLIER switch on the signal generator to the 10 position and rotate the MICROVOLTS control on the signal generator fully clockwise.

(12) Adjust the CARRIER CONTROL on the signal generator until an indication of 100 is obtained on the signal generator output meter.

(13) Adjust the MICROVOLTS control on the signal generator until an indication of 20 volts is obtained on the multimeter.

(14) Set the METER READS switch on the signal generator to the % MOD position and the MOD SELECTOR switch on the signal generator to the 400 cycle position.

(15) Adjust the % MODULATION control on the signal generator until an indication of 30 is obtained on the lower scale of the signal generator output meter.

(16) Set the METER READS switch on the signal generator to the RF position.

(17) Adjust, in turn, coils L-42, L-41, L-39, L-38, L-36, and L-32 (figure 2-1) until a maximum indication is obtained on the multimeter.

(18) Set the SELECTIVITY switch on the radio receiver to the . 2 XTAL position and adjust the signal generator tuning dial until a maximum indication is obtained on the multimeter.

(19) Set the SELECTIVITY switch on the radio receiver to the 3 NON-XTAL position and repeat step b(17).

(20) Set the SELECTIVITY switch on the radio receiver to the 1. 3 XTAL position and adjust coil L-37 (figure 2-1) until a maximum indication is obtained on the multimeter.

(21) Set the MOD-CW switch on the radio receiver to the CW position.

(22) If Radio Receiver SP-600-JX-17 is being aligned, set the BFO-AVC switch to the INT BFO - FAST position.

(23) Set the BEAT OSC control on the radio receiver to 0 and the MOD SELECTOR switch on the radio receiver to the OFF position.

(24) Allow 15 minutes for the receiver to warm up then adjust coil L-44 (figure 2-1) until an indication of zero volts is obtained on the multimeter.

(25) Rotate the CARRIER CONTROL on the signal generator fully counterclockwise and the MICROVOLTS control on the signal generator fully clockwise.

(26) Set the FREQUENCY BAND SWITCH on the signal generator to the Band F position and rotate the signal generator tuning dial until an indication of 3. 955 megacycles is obtained on the frequency and index scales.

(27) Set the MOD-CW switch on the radio receiver to the MOD position and the SELECTIVITY switch on the radio receiver to the 3 NON-XTAL position.

(28) Rotate the BAND CHANGE switch on the radio receiver until the indication 7. 4-14. 8 appears in the MEGACYCLES window.

(29) Adjust the CARRIER CONTROL on the signal generator until an indication of 100 is obtained on the signal generator output meter.

(30) Set the MOD SELECTOR switch on the signal generator to the 400 cycle position and adjust the MICROVOLTS control on the signal generator until an indication of 20 volts is obtained on the multimeter.

(31) Adjust, in turn, coils L-31, L-33, and L-34 (figure 2-1) until a maximum indication is obtained on the multimeter.

(32) Rotate the CARRIER CONTROL on the signal generator fully counterclockwise and the MICROVOLTS control on the signal generator fully clockwise.

(33) Set the MOD SELECTOR switch on the signal generator to the OFF position and rotate the RF GAIN control on the radio receiver counterclockwise to the OFF position.

(34) Remove the signal generator test leads from the radio receiver.

(35) Connect the antenna test cable to the radio receiver antenna input connector.

(36) Connect the antenna test cable to the signal generator as follows:

(a) Connect one end of the 121-ohm resistor to the center contact of the signal generator X MULT RF OUTPUT jack.

(b) Connect the other end of the 121-ohm resistor to ground terminal G.

c. Align the r-f stages of the radio receiver as follows:

(1) Set the FREQUENCY BAND SWITCH on the signal generator to the Band D position.

(2) Rotate the signal generator tuning dial until an indication of 0. 56 megacycle is obtained on the frequency and index scales.

(3) Adjust the CARRIER CONTROL until an indication of 100 is obtained on the signal generator output meter.

(4) Rotate the RF GAIN control on the radio receiver fully clockwise.

(5) Rotate the BAND CHANGE switch until the indication . 54-1. 35 appears in the MEGACYCLES window.

(6) Rotate the radio receiver TUNING control until an indication of 0. 56 megacycle is obtained on the main tuning and vernier dials.

(7) Set the AVC-MAN switch on the radio receiver to the AVC position and the FREQ CONTROL on the radio receiver to the VFP position.

(8) If Radio Receiver SP-600-JX-17 is being aligned, set the HFO switch to the VAR position.

(9) Adjust the MICROVOLTS control on the signal generator until an indication of 20 volts is obtained on the multimeter.

(10) Set the MOD SELECTOR switch on the signal generator to the 400 cycle position.

(11) Set the METER READS switch on the signal generator to the % MOD position and adjust the % MODULATION control on the signal generator until an indication of 30 is obtained on the lower scale of the signal generator output meter.

(12) Set the METER READS switch to the RF position.

(13) Remove the metal buttons that cover L and C of the four r-f tuner subassemblies on the radio receiver.

(14) Refer to figure 2-1 for Radio Receiver SP-600-JX-17, or figure 2-2 for Radio Receiver SP-600-JX-21. Adjust, in turn, variable-frequency oscillator L, antenna L, first r-f stage L and second r-f stage L until a maximum indication is obtained on the multimeter.

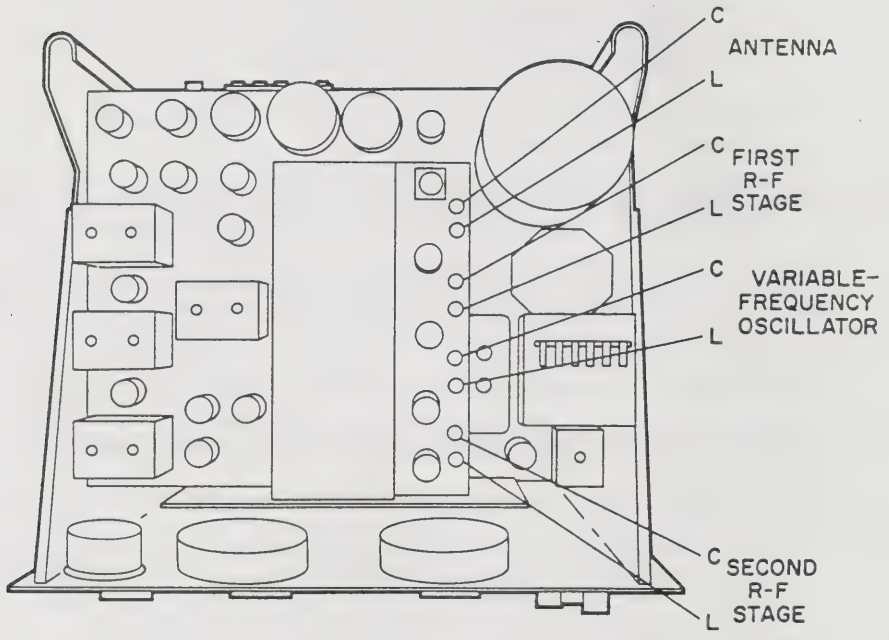


Figure 2-2. Radio Receiver SP-600-JX-21, Top View of R-F Section

(15) Rotate the CARRIER CONTROL on the signal generator fully counterclockwise and the MICROVOLTS control on the signal generator fully clockwise.

(16) Set the MOD SELECTOR switch on the signal generator to the OFF position.

(17) Set the FREQUENCY BAND SWITCH on the signal generator to the Band E position.

(18) Rotate the signal generator tuning dial until an indication of 1. 3 megacycles is obtained on the frequency and index scales.

(19) Rotate the radio receiver TUNING control until an indication of 1. 3 megacycles is obtained on the main tuning and vernier dials.

(20) Adjust the CARRIER CONTROL on the signal generator until an indication of 100 is obtained on the signal generator output meter.

(21) Adjust the MICROVOLTS control on the signal generator until an indication of 20 volts is obtained on the multimeter.

(22) Set the MOD SELECTOR switch on the signal generator to the 400 cycle position.

(23) Refer to figure 2-1 for Radio Receiver SP-600-JX-17, or figure 2-2 for Radio Receiver SP-600-JX-21. Adjust, in turn, variable-frequency oscillator C, antenna C, first r-f stage C, and second r-f stage C until a maximum indication is obtained on the multimeter.

(24) Rotate the CARRIER CONTROL on the signal generator fully counterclockwise and the MICROVOLTS control on the signal generator fully clockwise.

(25) Set the MOD SELECTOR switch on the signal generator to the OFF position.

(26) Repeat step c. (1) through (25) with exception of (7), (8) and (13).

(27) Set the MULTIPLIER switch on the signal generator to the . 1 position and adjust the CARRIER CONTROL on the signal generator until an indication of 100 is obtained on the signal generator output meter.

(28) Adjust the MICROVOLTS control on the signal generator until an indication of 30 is obtained on the upper scale of the signal generator output meter.

(29) Set the AVC-MAN switch on the radio receiver to the MAN position and adjust the RF GAIN control on the radio receiver until an indication of 20 volts is obtained on the multimeter.

(30) Repeat step c. (1) through (25) with exception of (7), (8) and (13).

(31) Rotate the signal generator tuning dial until an indication of 1. 4 megacycles is obtained on the frequency and vernier scales.

(32) Set the MULTIPLIER switch on the signal generator to the 10 position and adjust the CARRIER CONTROL on the signal generator until an indication of 100 is obtained on the signal generator output meter.

(33) Rotate the BAND CHANGE switch on the radio receiver until the indication 1. 35-3. 45 appears in the MEGACYCLES window.

(34) Rotate the radio receiver TUNING control until an indication of 1. 4 megacycles is obtained on the main tuning and vernier dials.

(35) Set the AVC-MAN switch on the radio receiver to the AVC position and rotate the RF GAIN control on the radio receiver fully clockwise.

(36) Adjust the MICROVOLTS control on the signal generator until an indication of 20 volts is obtained on the multimeter.

(37) Set the MOD SELECTOR switch on the signal generator to the 400 cycle position.

(38) Refer to figure 2-1 for Radio Receiver SP-600-JX-17 or figure 2-2 for Radio Receiver SP-600-JX-21. Adjust, in turn, variable-frequency oscillator L, antenna L, first r-f stage L, and second r-f stage L until a maximum indication is obtained on the multimeter.

(39) Rotate the CARRIER CONTROL on the signal generator fully counterclockwise and the MICROVOLTS control on the signal generator fully clockwise.

(40) Set the MOD SELECTOR switch on the signal generator to the OFF position.

(41) Set the FREQUENCY BAND SWITCH on the signal generator to the Band F position.

(42) Rotate the signal generator tuning dial until an indication of 3. 4 megacycles is obtained on the frequency and index scales.

(43) Rotate the radio receiver TUNING control until an indication of 3. 4 megacycles is obtained on the main tuning and vernier dials.

(44) Adjust the CARRIER CONTROL on the signal generator until an indication of 100 is obtained on the signal generator output meter.

(45) Adjust the MICROVOLTS control on the signal generator until an indication of 20 volts is obtained on the multimeter.

(46) Set the MOD SELECTOR switch on the signal generator to the 400 cycle position.

(47) Refer to figure 2-1 for Radio Receiver SP-600-JX-17 or figure 2-2 for Radio Receiver SP-600-JX-21. Adjust, in turn, variable-frequency oscillator C, antenna C, first r-f stage C, and second r-f stage C until a maximum indication is obtained on the multimeter.

(48) Rotate the CARRIER CONTROL on the signal generator fully counterclockwise and the MICROVOLTS control on the signal generator fully clockwise.

(49) Set the MOD SELECTOR switch on the signal generator to the OFF position.

(50) Repeat step c. (31) through (49).

(51) Repeat step c. (27) through (29).

(52) Repeat step c. (31) through (49).

(53) Rotate the signal generator tuning dial until an indication of 3. 75 megacycles is obtained on the frequency and index scales.

(54) Set the MULTIPLIER switch on the signal generator to the 10 position and adjust the CARRIER CONTROL on the signal generator until an indication of 100 is obtained on the signal generator output meter.

(55) Rotate the BAND CHANGE switch on the radio receiver until the indication 3. 45-7. 4 appears in the MEGACYCLES window.

(56) Rotate the receiver TUNING control until the main tuning and vernier dials indicate 3. 75 megacycles.

(57) Repeat step c. (35) through (37).

(58) Refer to figure 2-1 for Radio Receiver SP-600-JX-17 or figure 2-2 for Radio Receiver SP-600-JX-21. Adjust, in turn, variable-frequency oscillator L, antenna L, first r-f stage L, and second r-f stage L until a maximum indication is obtained on the multimeter.

(59) Repeat step c. (39) and (40).

(60) Rotate the signal generator tuning dial until an indication of 7. 15 megacycles is obtained on the frequency and index scales.

(61) Rotate the radio receiver TUNING control until an indication of 7. 15 megacycles is obtained on the main tuning and vernier dials.

(62) Repeat step c. (44) through (46).

(63) Refer to figure 2-1 for Radio Receiver SP-600-JX-17 or figure 2-2 for Radio Receiver SP-600-JX-21. Adjust, in turn, variable-frequency oscillator C, antenna C, first r-f stage C, and second r-f stage C until a maximum indication is obtained on the multimeter.

(64) Rotate the CARRIER CONTROL on the signal generator fully counterclockwise and the MICROVOLTS control on the signal generator fully clockwise.

(65) Set the MOD SELECTOR switch on the signal generator to the OFF position.

(66) Repeat step c. (53) through (65).

(67) Repeat step c. (27) through (29).

(68) Repeat step c. (53) through (65).

(69) Rotate the signal generator tuning dial until an indication of 7. 5 megacycles is obtained on the frequency and index scales.

(70) Set the MULTIPLIER switch on the signal generator to the 10 position and adjust the CARRIER CONTROL on the signal generator until an indication of 100 is obtained on the signal generator output meter.

(71) Rotate the BAND CHANGE switch on the radio receiver until the indication 7. 4-14. 8 appears in the MEGACYCLES window.

(72) Rotate the radio receiver TUNING control until an indication of 7. 5 megacycles is obtained on the main tuning and vernier dials.

(73) Repeat step c. (35) through (37).

(74) Refer to figure 2-1 for Radio Receiver SP-600-JX-17 or figure 2-2 for Radio Receiver SP-600-JX-21. Adjust, in turn, variable-frequency oscillator L, antenna L, first r-f stage L, and second r-f stage L until a maximum indication is obtained on the multimeter.

(75) Repeat step c. (39) and (40).

(76) Set the FREQUENCY BAND SWITCH on the signal generator to the Band G position.

(77) Rotate the signal generator tuning dial until an indication of 14. 5 megacycles is obtained on the frequency and index scales.

(78) Rotate the radio receiver TUNING control until an indication of 14. 5 megacycles is obtained on the main tuning and vernier dials.

(79) Repeat step c. (44) through (46).

(80) Refer to figure 2-1 for Radio Receiver SP-600-JX-17 or figure 2-2 for Radio Receiver SP-600-JX-21. Adjust, in turn, variable-frequency oscillator C, antenna C, first r-f stage C, and second r-f stage C until a maximum indication is obtained on the multimeter.

(81) Rotate the CARRIER CONTROL on the signal generator fully counterclockwise and the MICROVOLTS control on the signal generator fully clockwise.

(82) Set the MOD SELECTOR switch on the signal generator to the OFF position.

(83) Repeat step c. (69) through (82).

(84) Repeat step c. (27) through (29).

(85) Repeat step c. (69) through (82).

(86) Rotate the signal generator tuning dial until an indication of 15. 0 megacycles is obtained on the frequency and index scales.

(87) Set the MULTIPLIER switch on the signal generator to the 10 position and adjust the CARRIER CONTROL on the signal generator until an indication of 100 is obtained on the signal generator output meter.

(88) Rotate the BAND CHANGE switch on the radio receiver until the indication 14. 8-29. 7 appears in the MEGACYCLES window.

(89) Rotate the radio receiver TUNING control until an indication of 15. 0 megacycles is obtained on the main tuning and vernier dials.

(90) Repeat step c. (35) through (37).

(91) Refer to figure 2-1 for Radio Receiver SP-600-JX-17 or figure 2-2 for Radio Receiver SP-600-JX-21. Adjust, in turn, variable-frequency oscillator L, antenna L, first r-f stage L, and second r-f stage L until a maximum indication is obtained on the multimeter.

(92) Repeat step c. (39) and (40).

(93) Set the FREQUENCY BAND SWITCH on the signal generator to the Band H position and the CARRIER RANGE switch on the signal generator to the H position.

(94) Rotate the signal generator tuning dial until an indication of 29. 0 megacycles is obtained on the frequency and index scales.

(95) Rotate the radio receiver TUNING control until an indication of 29. 0 megacycles is obtained on the main tuning and vernier dials.

(96) Repeat step c. (44) through (46).

(97) Refer to figure 2-1 for Radio Receiver SP-600-JX-17 or figure 2-2 for Radio Receiver SP-600-JX-21. Adjust, in turn, variable-frequency oscillator C, antenna C, first r-f stage C, and second r-f stage C until a maximum indication is obtained on the multimeter.

(98) Rotate the CARRIER CONTROL on the signal generator fully counterclockwise and the MICROVOLTS control on the signal generator fully clockwise.

(99) Set the MOD SELECTOR switch on the signal generator to the OFF position.

(100) Repeat step c. (86) through (99).

(101) Repeat step c. (27) through (29).

(102) Repeat step c. (86) through (99).

(103) Rotate the signal generator tuning dial until an indication of 30. 0 megacycles is obtained on the frequency and index scales.

(104) Set the MULTIPLIER switch on the signal generator to the 10 position and adjust the CARRIER CONTROL on the signal generator until an indication of 100 is obtained on the signal generator output meter.

(105) Rotate the BAND CHANGE switch on the radio receiver until the indication 29. 7-54. 0 appears in the MEGACYCLES window.

(106) Rotate the radio receiver TUNING control until an indication of 30. 0 megacycles is obtained on the main tuning and vernier dials.

(107) Repeat step c. (35) through (37).

(108) Refer to figure 2-1 for Radio Receiver SP-600-JX-17 or figure 2-2 for Radio Receiver SP-600-JX-21. Adjust, in turn, variable-frrquency oscillator L, antenna L, first r-f stage L, and second r-f stage L until a maximum indication is obtained on the multimeter.

(109) Repeat step c. (39) and (40).

(110) Rotate the signal generator tuning dial until an indication of 26. 0 megacycles is obtained on the frequency and index scales.

(111) Rotate the radio receiver TUNING control until an indication of 52. 0 megacycles is obtained on the main tuning and vernier dials.

(112) Repeat step c. (44) through (46).

(113) Refer to figure 2-1 for Radio Receiver SP-600-JX-17 or figure 2-2 for Radio Receiver SP-600-JX-21. Adjust, in turn, variable-frequency oscillator C, antenna C, first r-f stage C, and second r-f stage C until a maximum indication is obtained on the multimeter.

(114) Rotate the CARRIER CONTROL on the signal generator fully counterclockwise and the MICROVOLTS control on the signal generator fully clockwise.

(115) Set the MOD SELECTOR switch on the signal generator to the OFF position.

(116) Repeat step c. (103) through (115).

(117) Repeat step c. (27) through (29).

(118) Repeat step c. (103) through (115).

(119) Rotate the RF GAIN control on the radio receiver counterclockwise to the OFF position.

d. Concluding Procedure

(1) Set the signal generator POWER ON-OFF switch to the OFF position and disconnect the antenna test cable from the radio receiver.

(2) Disconnect the power line plug of the signal generator from the power source.

(3) Disconnect the multimeter test leads from the radio receiver and disconnect the power line plug from the power source.

(4) Disconnect the power line plug of the receiver from the power source.

(5) Replace all the metal buttons removed from the r-f section of the radio receiver.

(6) Remove the 600-ohm resistor from the AUDIO OUTPUT terminals on the rear of the radio receiver.

(7) Remove the tube socket test adapter and replace tube V-5 in the socket.

(8) Replace the shield on tube V-5.

(9) Replace the top cover on the radio receiver and tighten the four thumb screws.

(10) Replace the radio receiver in the relay rack and tighten the eight holding screws to secure the radio receiver.

(11) Connect all the cables and wires to the respective terminals on the rear of the radio receiver.

(12) Insert the power line plug of the radio receiver into the 115-volt, 60-cycle power source.

SERVICING - RADIO RECEIVERS SP-600-JX-21 AND SP-600-JX-17, VARIABLE-FREQUENCY HETERODYNE OSCILLATOR ALIGNMENT

1. GENERAL INFORMATION

a. The purpose of this routine is to align the variable-frequency oscillator stage of Radio Receiver SP-600-JX-21 or SP-600-JX-17.

b. The approximate time required to do this routine is 2-1/2 man-hours.

2. TEST EQUIPMENT REQUIRED

a. Signal Generator AN/URM-25

b. Electronic Multimeter TS-505( )/U

3. MATERIAL REQUIRED

a. Screwdriver

b. Soldering iron

c. Resistor, 600-ohm, 2-watt, non-inductive

d. Resistors, 121-ohm, 1/2-watt, non-inductive, two

e. Black test lead

f. Two alligator clips

g. Connector plug PL-259

h. Connector plug UG-102/U

i. One 30-inch length of RG-22/U cable

j. One 30-inch length of RG-59/U cable

k. Alignment tool, insulated

l. Antenna test cable for Radio Receiver SP-600-JX-21 fabricated as follows:

(1) Remove 1-1/8 inches of outer insulation from both ends of the RG-22/U cable and cut the braid back 3/4 inch.

(2) Strip 5/8 inch of insulation from both conductors and tin the exposed conductors and braid.

(3) Disassemble the connector plug, UG-102/U and slide the coupling ring on the cable. Screw the back shell to the cable, aligning the solder hole with the conductors.

(4) Assemble the front shell to the back shell so that both solder holes are in line.

(5) Solder the braid to the shells through the solder holes and solder the conductors to the contacts.

(6) Screw the coupling ring on the back shell.

(7) Strip 5/8 inch of insulation from the center conductors on the other end of the cable.

(8) Solder a 121-ohm, 1/2-watt resistor between the two conductors.

m. Antenna test cable for Radio Receiver SP-600-JX-17 fabricated as follows:

(1) Remove 1-1/8 inches of outer insulation from both ends of the RG-59/U cable and cut the braid back 3/4 inch.

(2) Strip 5/8 inch of insulation from the center conductor and tin the exposed conductor and braid.

(3) Disassemble the connector plug, PL-259, and slide the coupling ring on the cable. Screw the plug subassembly to the cable.

(4) Solder the braid to the assembly through the solder hole and solder the center conductor to the contact.

(5) Screw the coupling ring to the plug subassembly.

(6) Unravel the exposed braid at the other end of the cable and twist it to form a lead. Strip 5/8 inch of insulation from the center conductor.

(7) Solder a 121-ohm, 1/2-watt resistor between the center conductor and the braid.

4. PROCEDURE

a. Preliminary Procedure

(1) Disconnect the power line plug of the radio receiver from the power source.

(2) Disconnect the loudspeaker from the AUDIO OUTPUT terminals.

(3) Disconnect the antenna cable from the antenna input connector.

(4) Disconnect the BFO, IFO, RF, GND, DIODE OUTPUT, and AVC connections from their respective terminals.

(5) Remove the eight screws holding the radio receiver in the relay rack and remove the receiver from the rack.

(6) Loosen the four thumb screws holding the top cover to the radio receiver and remove the cover.

(7) Insert the power line plug of the radio receiver into the 115-volt, 60-cycle power source.

(8) Connect the 600-ohm, 2-watt resistor between the AUDIO OUTPUT terminals on the rear of the radio receiver.

(9) Insert the power line plug of Electronic Multimeter TS-505( )/U into a 115-volt, 60-cycle power source.

(10) Connect the black test lead to the COMMON binding post on the multimeter.

(11) Connect an alligator clip to the other end of the black test lead and clip the lead to one side of the 600-ohm resistor connected between the AUDIO OUTPUT terminals on the rear of the radio receiver.

(12) Connect an alligator clip to the a-c probe of the multimeter and clip the probe to the other side of the 600-ohm resistor.

(13) Set the RANGE switch on the multimeter to the 4V/R x 10 position.

(14) Set the FUNCTION switch on the multimeter to the A.C. position and allow 3 minutes for the multimeter to warm up.

(15) Set up Signal Generator AN/URM-25( ) to deliver an unmodulated 0.56-megacycle r-f signal. Set up Signal Generator AN/URM-25 as follows:

(a) Insert the female plug of the power line into the socket located in the lower left corner of the signal generator front panel.

(b) Insert the male plug of the power line into a 115-volt, 60-cycle power source.

(c) Rotate the CARRIER CONTROL, the % MODULATION control, and the MICROVOLTS control on the signal generator fully counterclockwise.

(d) Set the FREQUENCY BAND SWITCH on the signal generator to the Band D position.

(e) Set the CARRIER RANGE switch on the signal generator to the DEFG position.

(f) Rotate the signal generator tuning dial until an indication of 0. 56 megacycle is obtained on the frequency and index scales.

(g) Set the MOD SELECTOR switch on the signal generator to the OFF position.

(h) Set the METER READS switch on the signal generator to the RF position.

(i) Set the POWER ON-OFF switch on the signal generator to the ON position and allow 15 minutes for the signal generator to warm up.

(16) Connect the antenna test cable to the antenna input connector of the radio receiver.

(17) Connect the antenna test cable to the signal generator as follows:

(a) Connect one end of the 121-ohm resistor to the center contact of the signal generator X MULT RF OUTPUT jack.

(b) Connect the other end of the 121-ohm resistor to ground terminal G.

(18) Set up Radio Receiver SP-600-JX-21 for reception of an amplitude-modulated signal as follows:

(a) Set the SEND-REC switch to the REC position.

(b) Set the FREQ CONTROL switch to the VFO position.

(c) Set the LIMITER-OFF switch to the OFF position.

(d) Set the AVC-MAN switch to the MAN position.

(19) Set up Radio Receiver SP-600-JX-17 for reception of an amplitude-modulated signal as follows:

(a) Set the SEND-REC switch to the REC position.

(b) Set the IFO switch to the INT position.

(c) Set the HFO switch to the VAR position.

(d) Set the LIMITER-OFF switch to the OFF position.

(e) Set the AVC-MAN switch to the MAN position.

b. Align the variable-frequency heterodyne oscillator as follows:

(1) Rotate the RF GAIN control on the radio receiver fully clockwise.

(2) Set the MOD-CW switch on the radio receiver to the MOD position.

(3) Set the SELECTIVITY switch on the radio receiver to the 3 NON-XTAL position.

(4) Set the MULTIPLIER switch on the signal generator to the . 1 position and adjust the CARRIER CONTROL until an indication of 100 is obtained on the output meter of the signal generator.

(5) Adjust the MICROVOLTS control on the signal generator until an indication of 30 is obtained on the upper scale of the signal generator output meter.

(6) Set the MOD SELECTOR switch on the signal generator to the 400 cycle position.

(7) Set the METER READS switch on the signal generator to the % MOD position and adjust the % MODULATION control until an indication of 30 is obtained on the lower scale of the signal generator output meter.

(8) Set the METER READS switch on the signal generator to the RF position.

(9) Rotate the BAND CHANGE switch on the radio receiver until the indication 0.54-1.35 appears in the MEGACYCLES window.

(10) Rotate the radio receiver TUNING control until an indication of 0.56 megacycle is obtained on the main tuning and vernier dials.

(11) Adjust the AUDIO GAIN control on the radio receiver until an indication of 2.45 volts is obtained on the multimeter.

(12) Refer to figure 2-3 for radio receiver SP-600-JX-21 or figure 2-4 for Radio Receiver SP-600-JX-17. Remove the metal cap and adjust variable-frequency oscillator L until a maximum indication is obtained on the multimeter.

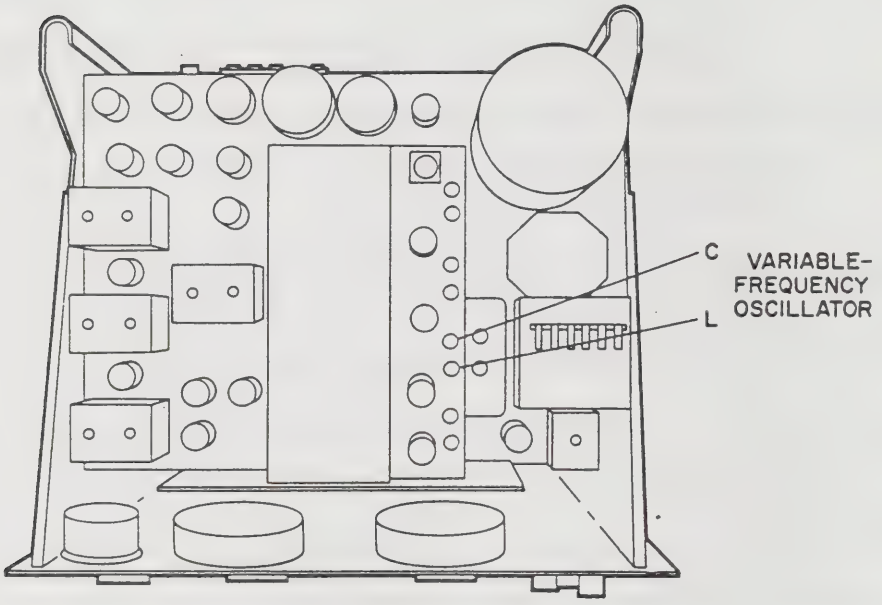


Figure 2-3. Radio Receiver SP-600-JX-21, Top View of R-F Section

(13) Rotate the CARRIER CONTROL on the signal generator fully counterclockwise and the MICROVOLTS control on the signal generator fully clockwise.

(14) Set the MOD SELECTOR switch on the signal generator to the OFF position.

(15) Set the FREQUENCY BAND SWITCH on the signal generator to the Band E position and rotate the signal generator tuning dial until an indication of 1.3 megacycles is obtained on the frequency and index scales.

(16) Rotate the radio receiver TUNING control until an indication of 1.3 megacycles is obtained on the main tuning and vernier dials.

(17) Adjust the CARRIER CONTROL on the signal generator until an indication of 100 is obtained on the signal generator output meter.

(18) Adjust the MICROVOLTS control on the signal generator until an indication of 30 is obtained on the upper scale of the signal generator output meter.

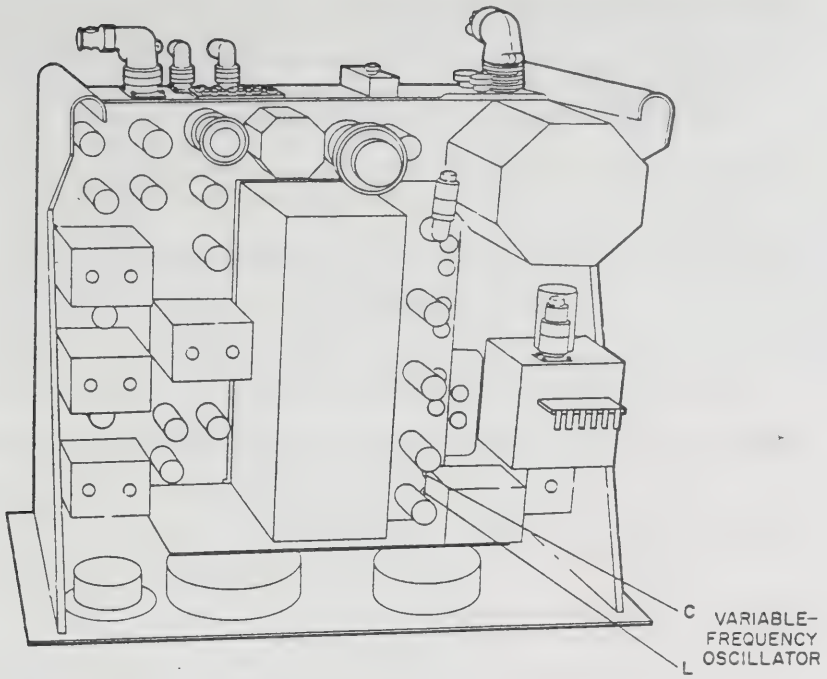


Figure 2-4. Radio Receiver SP-600-JX-17, Top View

(19) Set the MOD SELECTOR switch on the signal generator to the 400 cycle position.

(20) Refer to figure 2-3 for Radio Receiver SP-600-JX-21 or figure 2-4 for Radio Receiver SP-600-JX-17. Remove the metal cap and adjust variable-frequency oscillator C until a maximum indication is obtained on the multimeter.

(21) Rotate the CARRIER CONTROL on the signal generator fully counterclockwise and the MICROVOLTS control on the signal generator fully clockwise.

(22) Set the MOD SELECTOR switch on the signal generator to the OFF position.

(23) Repeat step b. (4) through (6) and (8) through (22).

(24) Rotate the signal generator tuning dial until an indication of 1.4 megacycles is obtained on the frequency and index scales.

(25) Rotate the BAND CHANGE switch on the radio receiver until the band indication 1.35-3.45 appears in the MEGACYCLES window.

(26) Rotate the radio receiver TUNING control until an indication of 1.4 megacycles is obtained on the main tuning and vernier dials.

(27) Repeat step b. (17) through (19).

(28) Refer to figure 2-3 for Radio Receiver SP-600-JX-21 or figure 2-4 for Radio Receiver SP-600-JX-17. Adjust variable-frequency oscillator L until a maximum indication is obtained on the multimeter.

(29) Repeat step b. (13) and (14).

(30) Set the FREQUENCY BAND SWITCH on the signal generator to the Band F position and rotate the signal generator tuning dial until an indication of 3.4 megacycles is obtained on the frequency and index scales.

(31) Rotate the radio receiver TUNING control until an indication of 3.4 megacycles is obtained on the main tuning and vernier dials.

(32) Repeat step b. (17) through (19).

(33) Refer to figure 2-3 for Radio Receiver SP-600-JX-21 or figure 2-4 for Radio Receiver SP-600-JX-17. Adjust variable-frequency oscillator C until a maximum indication is obtained on the multimeter.

(34) Rotate the CARRIER CONTROL on the signal generator fully counterclockwise and the MICROVOLTS control on the signal generator fully clockwise.

(35) Set the MOD SELECTOR switch on the signal generator to the OFF position.

(36) Repeat step b. (24) through (35).

(37) Rotate the signal generator tuning dial until an indication of 3.75 megacycles is obtained on the frequency and index scales.

(38) Rotate the BAND CHANGE switch on the radio receiver until the indication 3.45-7.4 appears in the MEGACYCLES window.

(39) Rotate the radio receiver TUNING control until an indication of 3.75 is obtained on the main tuning and vernier dials.

(40) Repeat step b. (17) through (19).

(41) Refer to figure 2-3 for Radio Receiver SP-600-JX-21 or figure 2-4 for Radio Receiver SP-600-JX-17. Adjust variable-frequency oscillator L until a maximum indication is obtained on the multimeter.

(42) Repeat step b. (13) and (14).

(43) Rotate the signal generator tuning dial until an indication of 7.15 megacycles is obtained on the frequency and index scales.

(44) Rotate the radio receiver TUNING control until an indication of 7.15 megacycles is obtained on the main tuning and vernier dials.

(45) Repeat step b. (17) through (19).

(46) Refer to figure 2-3 for Radio Receiver SP-600-JX-21 or figure 2-4 for Radio Receiver SP-600-JX-17. Adjust variable-frequency oscillator C until a maximum indication is obtained on the multimeter.

(47) Rotate the CARRIER CONTROL on the signal generator fully counterclockwise and the MICROVOLTS control on the signal generator fully clockwise.

(48) Set the MOD SELECTOR switch on the signal generator to the OFF position.

(49) Repeat step b. (37) through (48).

(50) Rotate the signal generator tuning dial until an indication of 7.5 megacycles is obtained on the frequency and index scales.

(51) Rotate the BAND CHANGE switch on the radio receiver until the indication 7.4-14.8 appears in the MEGACYCLES window.

(52) Rotate the radio receiver TUNING control until an indication of 7.5 megacycles is obtained on the main tuning and vernier dials.

(53) Repeat step b. (17) through (19).

(54) Refer to figure 2-3 for Radio Receiver SP-600-JX-21 or figure 2-4 for Radio Receiver SP-600-JX-17. Adjust variable-frequency oscillator L until a maximum indication is obtained on the multimeter.

(55) Repeat step b. (13) and (14).

(56) Set the FREQUENCY BAND SWITCH on the signal generator to the Band G position and rotate the signal generator tuning dial until an indication of 14. 5 megacycles is obtained on the frequency and index scales.

(57) Rotate the radio receiver TUNING control until an indication of 14. 5 megacycles is obtained on the main tuning and vernier dials.

(58) Repeat step b. (17) through (19).

(59) Refer to figure 2-3 for Radio Receiver SP-600-JX-21 or figure 2-4 for Radio Receiver SP-600-JX-17. Adjust variable-frequency oscillator C until a maximum indication is obtained on the multimeter.

(60) Rotate the CARRIER CONTROL on the signal generator fully counterclockwise and the MICROVOLTS control on the signal generator fully clockwise.

(61) Set the MOD SELECTOR switch on the signal generator to the OFF position.

(62) Repeat step b. (50) through (61).

(63) Rotate the signal generator tuning dial until an indication of 15. 0 megacycles is obtained on the frequency and index scales.

(64) Rotate the BAND CHANGE switch on the radio receiver until the indication 14. 8-29. 7 appears in the MEGACYCLES window.

(65) Rotate the radio receiver TUNING control until an indication of 15. 0 megacycles is obtained on the main tuning and vernier dials.

(66) Repeat step b. (17) through (19).

(67) Refer to figure 2-3 for Radio Receiver SP-600-JX-21 or figure 2-4 for Radio Receiver SP-600-JX-17. Adjust variable-frequency oscillator L until a maximum indication is obtained on the multimeter.

(68) Repeat step b. (13) and (14).

(69) Set the FREQUENCY BAND SWITCH on the signal generator to the Band H position and also set CARRIER RANGE switch to the H position.

(70) Rotate the signal generator tuning dial until an indication of 29. 0 megacycles is obtained on the frequency and index scales.

(71) Rotate the radio receiver TUNING control until an indication of 29. 0 megacycles is obtained on the main tuning and vernier dials.

(72) Repeat step b. (17) through (19).

(73) Refer to figure 2-3 for Radio Receiver SP-600-JX-21 or figure 2-4 for Radio Receiver SP-600-JX-17. Adjust variable-frequency oscillator C until a maximum indication is obtained on the multimeter.

(74) Rotate the CARRIER CONTROL on the signal generator fully counterclockwise and the MICROVOLTS control on the signal generator fully clockwise.

(75) Set the MOD SELECTOR switch on the signal generator to the OFF position.

(76) Repeat step b. (63) through (75).

(77) Rotate the signal generator tuning dial until an indication of 30. 0 megacycles is obtained on the frequency and index scales.

(78) Rotate the BAND CHANGE switch on the radio receiver until the indication 29. 7-54. 0 appears in the MEGACYCLES window.

(79) Rotate the radio receiver TUNING control until an indication of 30. 0 megacycles is obtained on the main tuning and vernier dials.

(80) Repeat step b. (17) through (19).

(81) Refer to figure 2-3 for Radio Receiver SP-600-JX-21 or figure 2-4 for Radio Receiver SP-600-JX-17. Adjust variable-frequency oscillator L until a maximum indication is obtained on the multimeter.

(82) Repeat step b. (13) and (14).

(83) Rotate the signal generator tuning dial until an indication of 26. 0 megacycles is obtained on the frequency and index scales.

(84) Rotate the radio receiver TUNING control until an indication of 52. 0 megacycles is obtained on the main tuning and vernier dials.

(85) Repeat step b. (17) through (19).

(86) Refer to figure 2-3 for Radio Receiver SP-600-JX-21 or figure 2-4 for Radio Receiver SP-600-JX-17. Adjust variable-frequency oscillator C until a maximum indication is obtained on the multimeter.

(87) Rotate the CARRIER CONTROL on the signal generator fully counterclockwise and the MICROVOLTS control on the signal generator fully clockwise.

(88) Set the MOD SELECTOR switch on the signal generator to the OFF position.

(89) Repeat step b. (77) through (88) .

(90) Rotate the RG GAIN control on the radio receiver counterclockwise to the OFF position.

c. Concluding Procedure

(1) Set the signal generator POWER ON-OFF switch to the OFF position and disconnect the antenna test cable from the radio receiver.

(2) Disconnect the power line plug of the signal generator from the power source.

(3) Disconnect the multimeter test leads from the radio receiver and the multimeter power line plug from the power source.

(4) Disconnect the power line plug of the radio receiver from the power source.

(5) Replace all the metal buttons removed from the radio receiver.

(6) Remove the 600-ohm resistor from the AUDIO OUTPUT terminals on the rear of the radio receiver.

(7) Replace the top cover of the radio receiver and tighten the four thumb screws.

(8) Replace the radio receiver in the rack and tighten the eight holding screws to secure the receiver.

(9) Connect all the cables and wires to their respective terminals on the rear of the radio receiver.

(10) Insert the power line plug of the radio receiver into a 115-volt, 60-cycle power source.

SERVICING - RADIO RECEIVERS SP-600-JX-21 AND SP-600-JX-17, RADIO-FREQUENCY TUNER ALIGNMENT

1. GENERAL INFORMATION

a. The purpose of this routine is to align the radio-frequency tuner assembly of Radio Receiver SP-600-JX-21 or SP-600-JX-17.

b. The approximate time required to do this routine is 2-1/2 man-hours.

c. The intermediate-frequency stages of the radio receiver must be aligned before the following routine is performed.

2. TEST EQUIPMENT REQUIRED

a. Signal Generator AN/URM-25

b. Electronic Multimeter TS-505( )/U

3. MATERIAL REQUIRED

a. Screwdriver

b. Soldering iron

c. Resistor, 600-ohm, 2-watt, non-inductive

d. Resistors, 121-ohm, 1/2-watt, non-inductive, two

e. Black test lead

f. Two alligator clips

g. Connector plug PL-259

h. Connector plug UG-102/U

i. One 30-inch length of RG-22/U cable

j. One 30-inch length of RG-59/U cable

k. Alignment tool, insulated

l. Antenna test cable for Radio Receiver SP-600-JX-21 fabricated as follows:

(1) Remove 1-1/8 inches of outer insulation from both ends of the RG-22/U cable and cut the braid back 3/4 inch.

(2) Strip 5/8 inch of insulation from both conductors and tin the exposed conductors and braid.

(3) Disassemble the connector plug, UG-102/U, and slide the coupling ring on the cable. Screw the back shell to the cable, aligning the solder hole with the conductors.

(4) Assemble the front shell to the back shell so that both solder holes are in line.

(5) Solder the braid to the shells through the solder holes and solder the conductors to the contacts.

(6) Screw the coupling ring to the back shell.

(7) Strip 5/8 inch of insulation from the center conductors on the other end of the cable.

(8) Solder a 121-ohm, 1/2-watt resistor between the two conductors.

m. Antenna test cable for Radio Receiver SP-600-JX-17 fabricated as follows:

(1) Remove 1-1/8 inches of outer insulation from both ends of the RG-59/U cable and cut the braid back 3/4 inch.

(2) Strip 5/8 inch of insulation from the center conductor and tin the exposed conductor and braid.

(3) Disassemble the connector plug, PL-259, and slide the coupling ring on the cable. Screw the plug subassembly on the cable.

(4) Solder the braid to the assembly through the solder hole and solder the center conductor to the contact.

(5) Screw the coupling ring to the plug subassembly.

(6) Unravel the exposed braid at the other end of the cable and twist it to form a lead. Strip 5/8 inch of insulation from the center conductor.

(7) Solder a 121-ohm, 1/2-watt resistor between the center conductor and the braid.

4. PROCEDURE

a. Preliminary Procedure

(1) Disconnect the power line plug of the radio receiver from the power source.

(2) Disconnect the loudspeaker from the AUDIO OUTPUT terminals.

(3) Disconnect the antenna cable from the antenna input connector.

(4) Disconnect the BFO, IFO, DIODE OUTPUT and AVC leads from their respective terminals.

(5) Remove the eight screws holding the radio receiver in the relay rack and remove the receiver from the rack.

(6) Loosen the four thumb screws holding the top cover to the radio receiver and remove the cover.

(7) Insert the power line plug of the radio receiver into the 115-volt, 60-cycle power source.

(8) Connect the 600-ohm, 2-watt resistor between the AUDIO OUTPUT terminals and connect a jumper between the JUMPER terminals.

(9) Insert the power line plug of Electronic Multimeter TS-505( )/U into a 115-volt, 60-cycle power source.

(10) Connect the black test lead to the COMMON binding post on the multimeter.

(11) Connect an alligator clip to the other end of the test lead and clip the lead to one side of the 600-ohm resistor connected between the AUDIO OUTPUT terminals.

(12) Connect an alligator clip to the a-c probe and clip the probe to the other side of the 600-ohm resistor.

(13) Set the RANGE switch on the multimeter to the 4V/R x 10 position.

(14) Set the FUNCTION switch on the multimeter to the A.C. position and allow 3 minutes for the multimeter to warm up.

(15) Set up signal generator AN/URM-25( ) to deliver an unmodulated 0.56-megacycle r-f signal. Set up signal generator AN/URM-25 as follows:

(a) Insert the female plug of the power line in the socket located in the lower left corner of the signal generator front panel.

(b) Insert the male plug of the power line into a 115-volt, 60-cycle power source.

(c) Rotate the CARRIER CONTROL and the % MODULATION control on the signal generator fully counterclockwise.

(d) Set the FREQUENCY BAND SWITCH on the signal generator to the Band D position.

(e) Set the CARRIER RANGE switch on the signal generator to the DEFG position.

(f) Rotate the signal generator tuning dial until an indication of 0.56 megacycle is obtained on the frequency and index scales.

(g) Set the MOD SELECTOR switch on the signal generator to the OFF position.

(h) Set the METER READS switch on the signal generator to the RF position.

(i) Set the POWER ON-OFF switch to the ON position and allow 15 minutes for the signal generator to warm up.

(16) Connect the antenna test cable to the antenna input connector of the radio receiver.

(17) Connect the antenna test cable to the signal generator as follows:

(a) Connect one end of the 121-ohm resistor to the center contact of the signal generator X MULT RF OUTPUT jack.

(b) Connect the other end of the 121-ohm resistor to ground terminal G.

(18) Set up Radio Receiver SP-600-JX-21 for the reception of an amplitude-modulated signal as follows:

(a) Set the SEND-REC switch to the REC position.

(b) Set the FREQ CONTROL switch to the VFO position.

(c) Set the LIMITER-OFF switch to the OFF position.

(d) Set the AVC-MAN switch tothe AVC position.

(19) Set up Radio Receiver SP-600-JX-17 for the reception of an amplitude-modulated signal as follows:

(a) Set the SEND-REC switch to the REC position.

(b) Set the IFO switch to the INT position.

(c) Set the HFO switch to the VAR position.

(d) Set the LIMITER-OFF switch to the OFF position.

(e) Set the AVC-MAN switch to the AVC position.

b. Align the r-f tuner of the radio receiver as follows:

(1) Rotate the RF GAIN control on the radio receiver fully clockwise.

WARNING

Dangerous voltages are present in the unit under test. Observe all safety precautions.

(2) Set the MOD-CW switch on the radio receiver to the MOD position.

(3) Set the SELECTIVITY switch on the radio receiver to the 3 NON-XTAL position.

(4) Set the MULTIPLIER switch on the signal generator to the .1 position and adjust the CARRIER CONTROL until an indication of 100 is obtained on the signal generator output meter.

(5) Adjust the MICROVOLTS control on the signal generator until an indication of 30 is obtained on the upper scale of the signal generator output meter.

(6) Set the MOD SELECTOR switch on the signal generator to the 400 cycle position.

(7) Set the METER READS switch on the signal generator to the % MOD position and adjust the % MODULATION control until an indication of 30 is obtained on the lower scale of the signal generator output meter.

(8) Set the METER READS switch on the signal generator to the RF position.

(9) Rotate the BAND CHANGE switch on the radio receiver until the indication 0.54-1.35 appears in the MEGACYCLES window.

(10) Rotate the radio receiver TUNING control until an indication of 0.56 megacycle is obtained on the main tuning and vernier dials.

(11) Adjust the AUDIO GAIN control on the radio receiver until an indication of 2.45 volts is obtained on the multimeter.

(12) Refer to figure 2-5 for Radio Receiver SP-600-JX-21 or figure 2-6 for Radio Receiver SP-600-JX-17. Remove the metal caps and adjust, in turn, variable-frequency oscillator L, antenna L, first r-f stage L, and second r-f stage L until a maximum indication is obtained on the multimeter.

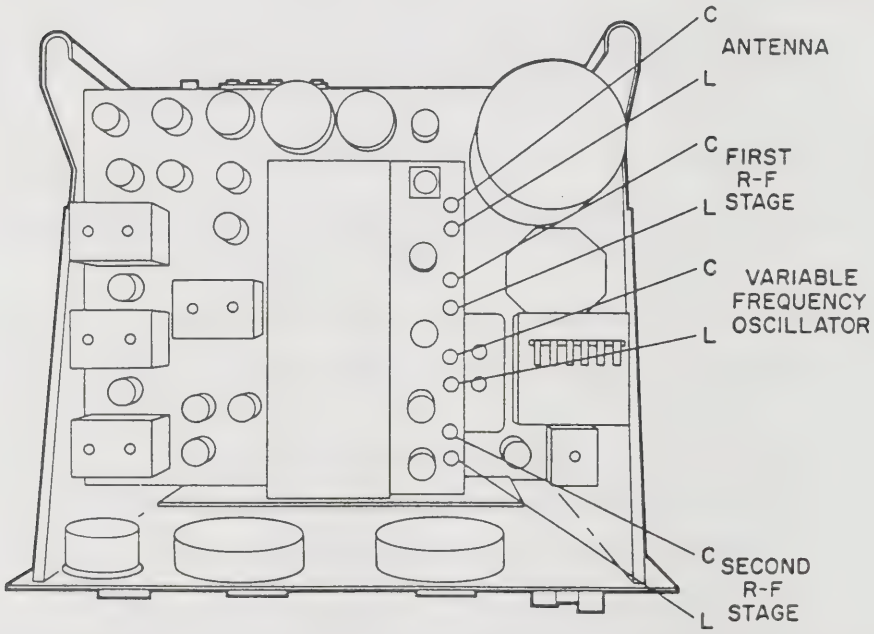


Figure 2-5. Radio Receiver SP-600-JX-21, Top View of R-F Section

(13) Rotate the CARRIER CONTROL on the signal generator fully counterclockwise.

(14) Set the MOD SELECTOR switch on the signal generator to the OFF position.

(15) Set the FREQUENCY BAND SWITCH on the signal generator to the Band E position and rotate the signal generator tuning dial until an indication of 1.3 megacycles is obtained on the frequency and index scales.

(16) Rotate the radio receiver TUNING control until an indication of 1.3 megacycles

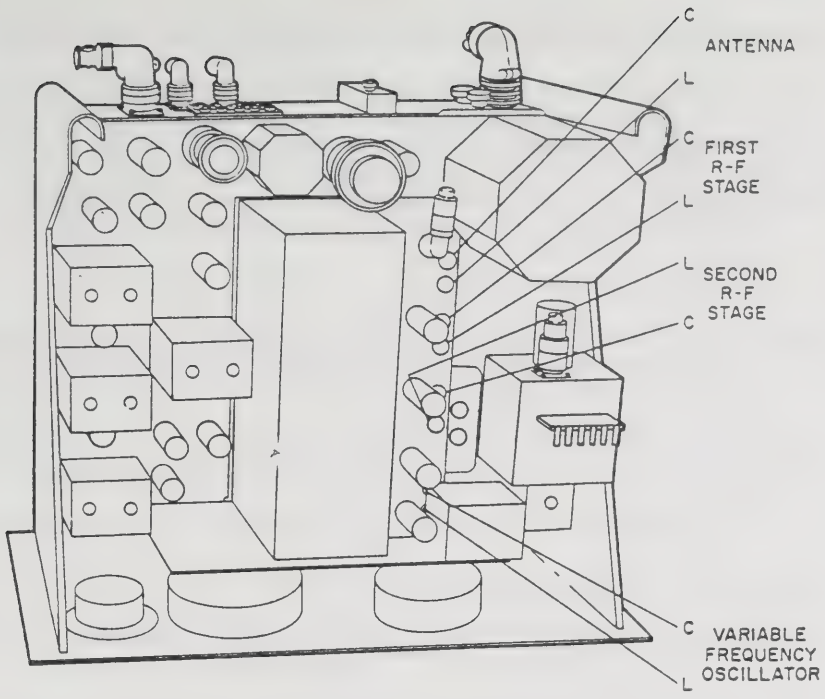


Figure 2-6. Radio Receiver SP-600-JX-17, Top View

is obtained on the main tuning and vernier dials.

(17) Adjust the CARRIER CONTROL on the signal generator until an indication of 100 is obtained on the signal generator output meter.

(18) Adjust the MICROVOLTS control on the signal generator until an indication of 30 is obtained on the upper scale of the signal generator output meter.

(19) Set the MOD SELECTOR switch on the signal generator to the 400 cycle position.

(20) Refer to figure 2-5 for Radio Receiver SP-600-JX-21 or figure 2-6 for Radio Receiver SP-600-JX-17. Adjust, in turn, variable-frequency oscillator C, antenna C, first r-f stage C, and second r-f stage C until a maximum indication is obtained on the multimeter.

(21) Rotate the CARRIER CONTROL on the signal generator fully counterclockwise.

(22) Set the MOD SELECTOR switch on the signal generator to the OFF position.

(23) Repeat step b. (4) through (6) and (8) through (22).

(24) Rotate the signal generator tuning dial until an indication of 1. 4 megacycles is obtained on the frequency and index scales.

(25) Rotate the BAND CHANGE switch on the radio receiver until the indication 1. 35-3. 45 appears in the MEGACYCLES window.

(26) Rotate the radio receiver TUNING control until an indication of 1. 4 megacycles is obtained on the main tuning and vernier dials.

(27) Repeat step b. (17) through (19).

(28) Refer to figure 2-5 for Radio Receiver SP-600-JX-21 or figure 2-6 for Radio Receiver SP-600-JX-17. Adjust, in turn, variable-frequency oscillator L, antenna L, first r-f stage L, and second r-f stage L until a maximum indication is obtained on the multimeter.

(29) Repeat step b. (13) and (14).

(30) Set the FREQUENCY BAND SWITCH on the signal generator to the Band F position and rotate the signal generator tuning dial until an indication of 3.4 megacycles is obtained on the frequency and index scales.

(31) Rotate the radio receiver TUNING control until an indication of 3.4 megacycles is obtained on the main tuning and vernier dials.

(32) Repeat step b. (17) through (19).

(33) Refer to figure 2-5 for Radio Receiver SP-600-JX-21 or figure 2-6 for Radio Receiver SP-600-JX-17. Adjust, in turn, variable-frequency oscillator C, antenna C, first r-f stage C, and second r-f stage C until a maximum indication is obtained on the multimeter.

(34) Rotate the CARRIER CONTROL on the signal generator fully counterclockwise.

(35) Set the MOD SELECTOR switch on the signal generator to the OFF position.

(36) Repeat step b. (24) through (35).

(37) Rotate the signal generator tuning dial until an indication of 3.75 megacycles is obtained on the frequency and index scales.

(38) Rotate the BAND CHANGE switch on the radio receiver until the indication 3.45-7.4 appears in the MEGACYCLES window.

(39) Rotate the radio receiver TUNING control until an indication of 3.75 megacycles is obtained on the main tuning and vernier dials.

(40) Repeat step b. (17) through (19).

(41) Refer to figure 2-5 for Radio Receiver SP-600-JX-21 or figure 2-6 for Radio Receiver SP-600-JX-17. Adjust, in turn, variable-frequency oscillator L, antenna L, first r-f stage L, and second r-f stage L until a maximum indication is obtained on the multimeter.

(42) Repeat step b. (13) and (14).

(43) Rotate the signal generator tuning dial until an indication of 7.15 megacycles is obtained on the frequency and index scales.

(44) Rotate the radio receiver TUNING control until an indication of 7.15 megacycles is obtained on the main tuning and vernier dials.

(45) Repeat step b. (17) through (19).

(46) Refer to figure 2-5 for Radio Receiver SP-600-JX-21 or figure 2-6 for Radio Receiver SP-600-JX-17. Adjust, in turn, variable-frequency oscillator C, antenna C, first r-f stage C, and second r-f stage C until a maximum indication is obtained on the multimeter.

(47) Rotate the CARRIER CONTROL on the signal generator fully counterclockwise.

(48) Set the MOD SELECTOR switch on the signal generator to the OFF position.

(49) Repeat step b. (37) through (48).

(50) Rotate the signal generator tuning dial until an indication of 7.5 megacycles is obtained on the frequency and index scales.

(51) Rotate the BAND CHANGE switch on the radio receiver until the indication 7.4-14.8 appears in the MEGACYCLES window.

(52) Rotate the radio receiver TUNING control until an indication of 7.5 megacycles

is obtained on the main tuning and vernier dials.

(53) Repeat step b. (17) through (19).

(54) Refer to figure 2-5 for Radio Receiver SP-600-JX-21 or figure 2-6 for Radio Receiver SP-600-JX-17. Adjust, in turn, variable-frequency oscillator L, antenna L, first r-f stage L, and second r-f stage L until a maximum indication is obtained on the multimeter.

(55) Repeat step b. (13) and (14).

(56) Set the FREQUENCY BAND SWITCH on the signal generator to the Band G position and rotate the signal generator tuning dial until an indication of 14. 5 megacycles is obtained on the frequency and index scales.

(57) Rotate the radio receiver TUNING control until an indication of 14. 5 megacycles on the main tuning and vernier dials.

(58) Repeat step b. (17) through (19).

(59) Refer to figure 2-5 for Radio Receiver SP-600-JX-21 or figure 2-6 for Radio Receiver SP-600-JX-17. Adjust, in turn, variable-frequency oscillator C, antenna C, first r-f stage C, and second r-f stage C until a maximum indication is obtained on the multimeter.

(60) Rotate the CARRIER CONTROL on the signal generator fully counterclockwise.

(61) Set the MOD SELECTOR switch on the signal generator to the OFF position.

(62) Repeat step b. (50) through (61).

(63) Rotate the signal generator tuning dial until an indication of 15 megacycles is obtained on the frequency and index scales.

(64) Rotate the BAND CHANGE switch on the radio receiver until the indication 14. 8-29. 7 appears in the MEGACYCLES window.

(65) Rotate the radio receiver TUNING control until an indication of 15. 0 megacycles is obtained on the main tuning and vernier dials.

(66) Repeat step b. (17) through (19).

(67) Refer to figure 2-5 for Radio Receiver SP-600-JX-21 or figure 2-6 for Radio Receiver SP-600-JX-17. Adjust, in turn, variable-frequency oscillator L, antenna L, first r-f stage L, and second r-f stage L until a maximum indication is obtained on the multimeter.

(68) Repeat step b. (13) and (14).

(69) Set the FREQUENCY BAND SWITCH on the signal generator to the Band H position and the CARRIER RANGE switch on the signal generator to the H position.

(70) Rotate the signal generator tuning dial until an indication of 29. 0 megacycles is obtained on the frequency and index scales.

(71) Rotate the radio receiver TUNING control until an indication of 29. 0 megacycles is obtained on the main tuning and vernier dials.

(72) Repeat step b. (17) through (19).

(73) Refer to figure 2-5 for Radio Receiver SP-600-JX-21 or figure 2-6 for Radio Receiver SP-600-JX-17. Adjust, in turn, variable-frequency oscillator C, antenna C, first r-f stage C, and second r-f stage C until a maximum indication is obtained on the multimeter.

(74) Rotate the CARRIER CONTROL on the signal generator fully counterclockwise.

(75) Set the MOD SELECTION switch on the signal generator to the OFF position.

(76) Repeat step b. (63) through (75).

(77) Rotate the signal generator tuning dial until an indication of 30.0 megacycles is obtained on the frequency and index scales.

(78) Rotate the BAND CHANGE switch on the radio receiver until the indication 29.7-54.0 appears in the MEGACYCLES window.

(79) Rotate the radio receiver TUNING control until an indication of 30.0 megacycles is obtained on the main tuning and vernier dials.

(80) Repeat step b. (17) through (19).

(81) Refer to figure 2-5 for Radio Receiver SP-600-JX-21 or figure 2-6 for Radio Receiver SP-600-JX-17. Adjust, in turn, variable-frequency oscillator L, antenna L, first r-f stage L, and second r-f stage L until a maximum indication is obtained on the multimeter.

(82) Repeat step b. (13) and (14).

(83) Rotate the signal generator tuning dial until an indication of 26.0 megacycles is obtained on the frequency and index scales.

(84) Rotate the radio receiver TUNING control until an indication of 52.0 megacycles is obtained on the main tuning and vernier dials.

(85) Repeat step b. (17) through (19).

(86) Refer to figure 2-5 for Radio Receiver SP-600-JX-21 or figure 2-6 for Radio Receiver SP-600-JX-17. Adjust, in turn, variable-frequency oscillator C, antenna C, first r-f stage C, and second r-f stage C until a maximum indication is obtained on the multimeter.

(87) Rotate the CARRIER CONTROL on the signal generator fully counterclockwise.

(88) Set the MOD SELECTOR switch on the signal generator to the OFF position.

(89) Repeat step b. (77) through (88).

(90) Rotate the RF GAIN control on the radio receiver counterclockwise to the OFF position.

c. Concluding Procedure

(1) Set the signal generator POWER ON-OFF switch to the OFF position and disconnect the antenna test cable from the radio receiver.

(2) Disconnect the power line plug of the signal generator from the power source.

(3) Disconnect the multimeter test leads from the radio receiver and the power line plug of the multimeter from the power source.

(4) Disconnect the power line plug of the radio receiver from the power source.

(5) Replace the metal buttons removed in step b. (12).

(6) Remove the 600-ohm resistor from the AUDIO OUTPUT terminals of the radio receiver.

(7) Replace the top cover of the radio receiver and tighten the four thumb screws.

(8) Replace the radio receiver in the relay rack and tighten the eight holding screws to secure the radio receiver.

(9) Connect all the cables and wires to their respective terminals on the rear of the radio receiver.

(10) Insert the power line plug of the radio receiver into the 115-volt 60-cycle power source.

SERVICING - RADIO RECEIVERS SP-600-JX-21 AND SP-600-JX-17,
TUNING METER ADJUSTMENT

1. GENERAL INFORMATION

a. The purpose of this routine is to adjust the tuning meter of Radio Receiver SP-600-JX-21 or SP-600-JX-17.

b. The approximate time required to do this routine is 1-1/2 man-hours.

2. TEST EQUIPMENT REQUIRED

a. Signal Generator AN/URM-25

b. Electronic Multimeter TS-505( )/U

3. MATERIAL REQUIRED

a. Screwdriver

b. Soldering iron

c. Resistor, 600-ohm, 2-watt, non-inductive

d. Resistors, 121-ohm, 1/2-watt, non-inductive, two

e. Black test lead

f. Two alligator clips

g. Connector plug PL-259

h. Connector plug UG-102/U

i. One 30-inch length of RG-22/U cable

j. One 30-inch length of RG-59/U cable

k. Headset HS-33

l. Antenna test cable for Radio Receiver SP-600-JX-21 fabricated as follows:

(1) Remove 1-1/8 inches of outer insulation from both ends of the RG-22/U cable and cut the braid back 3/4 inch.

(2) Strip 5/8 inch of insulation from both conductors and tin the exposed conductors and braid.

(3) Disassemble the connector plug, UG-102/U, and slide the coupling ring on the cable. Screw the back shell to the cable, aligning the solder hole with the conductors.

(4) Assemble the front shell to the back shell so that both solder holes are in line.

(5) Solder the braid to the shells through the solder holes and solder the conductors to the contacts.

(6) Screw the coupling ring to the back shell.

(7) Strip 5/8 inch of insulation from the center conductors on the other end of the cable.

(8) Solder a 121-ohm, 1/2-watt resistor between the two conductors.

m. Antenna test cable for Radio Receiver SP-600-JX-17 fabricated as follows:

(1) Remove 1-1/8 inches of outer insulation from both ends of the RG-59/U cable and cut the braid back 3/4 inch.

(2) Strip 5/8 inch of insulation from the center conductor and tin the exposed conductor and braid.

(3) Disassemble the connector plug, PL-259, and slide the coupling ring on the cable. Screw the plug subassembly to the cable.

(4) Solder the braid to the assembly through the solder hole and solder the center conductor to the contact.

(5) Screw the coupling ring to the plug subassembly.

(6) Unravel the exposed braid at the other end of the cable and twist it to form a lead. Strip 5/8 inch of insulation from the center conductor.

(7) Solder a 121-ohm, 1/2-watt resistor between the center conductor and the braid.

4. PROCEDURE

a. Preliminary Procedure

(1) Disconnect the power line plug of the radio receiver from the power source.

(2) Disconnect the loudspeaker from the AUDIO OUTPUT terminals.

(3) Disconnect the antenna cable from the antenna input connector.

(4) Disconnect the BFO, IFO, GND, DIODE OUTPUT, and AVC leads from their respective terminals.

(5) Remove the eight screws holding the radio receiver in the relay rack and remove the receiver from the rack.

(6) Loosen the four thumb screws holding the top cover to the radio receiver and remove the cover.

(7) Insert the power line plug of the radio receiver into the 115-volt, 60-cycle power source.

(8) Connect the 600-ohm, 2-watt resistor between the AUDIO OUTPUT terminals and connect a jumper between the JUMPER terminals on the radio receiver.

(9) Set up Signal Generator AN/URM-25( ) to deliver an unmodulated 2-megacycle r-f signal. Set up Signal Generator AN/URM-25 as follows:

(a) Insert the female plug of the power line into the socket located in the lower left corner of the signal generator front panel.

(b) Insert the male plug of the power line into the 115-volt, 60-cycle power source.

(c) Rotate the CARRIER CONTROL and the % MODULATION control on the signal generator fully counterclockwise.

(d) Set the FREQUENCY BAND SWITCH on the signal generator to the Band F position.

(e) Set the CARRIER RANGE switch on the signal generator to the DEFG position.

(f) Rotate the signal generator tuning dial until an indication of 2 megacycles is obtained on the frequency and index scales.

(g) Set the MOD SELECTOR switch on the signal generator to the OFF position.

(h) Set the METER READS switch on the signal generator to the RF position.

(i) Set the POWER ON-OFF switch on the signal generator to the ON position and allow 15 minutes for the signal generator to warm up.

(10) Connect the antenna test cable to the antenna input connector of the radio receiver.

(11) Connect the antenna test cable to the signal generator as follows:

(a) Connect one end of the 121-ohm resistor to the center contact of the signal generator X·MULT RF OUTPUT jack.

(b) Connect the other end of the 121-ohm resistor to ground terminal G.

(12) Set up Radio Receiver SP-600-JX-21 for the reception of an amplitude-modulated signal as follows:

(a) Set the SEND-REC switch to the REC position.

(b) Set the FREQ CONTROL switch to the VFO position.

(c) Set the LIMITER-OFF switch to the OFF position.

(d) Set the AVC-MAN switch to the AVC position.

(13) Set up Radio Receiver SP-600-JX-17 for the reception of an amplitude-modulated signal as follows:

(a) Set the SEND-REC switch to the REC position.

(b) Set the IFO switch to the INT position.

(c) Set the HFO switch to the VAR position.

(d) Set the LIMITER-OFF switch to the OFF position.

(e) Set the AVC-MAN switch to the AVC position.

b. Adjust the METER ADJ RF control on the radio receiver as follows:

(1) Rotate the RF GAIN control on the radio receiver fully clockwise.

(2) Set the MOD-CW switch on the radio receiver to the MOD position.

(3) If the adjustment is being performed on Radio Receiver SP-600-JX-17 set the BFO-AVC switch to the INT BFO-FAST position.

(4) Set the METER switch on the radio receiver to the RF position.

(5) Rotate the MICROVOLTS control on the signal generator fully clockwise.

(6) Set the MULTIPLIER switch on the signal generator to the . 1 position and adjust the CARRIER CONTROL until an indication of 100 is obtained on the signal generator output meter.

(7) Set the SELECTIVITY switch on the radio receiver to the 3 NON-XTAL position.

(8) Set the MOD SELECTOR switch on the signal generator to the 400 cycle position and the METER READS switch to the % MOD position.

(9) Adjust the % MODULATION control on the signal generator until an indication of 30 is obtained on the lower scale of the signal generator output meter.

(10) Set the METER READS switch on the signal generator to the RF position.

(11) Rotate the BAND CHANGE switch on the radio receiver until the indication 1. 35-3. 45 appears in the MEGACYCLES window.

(12) Rotate the radio receiver TUNING control until an indication of 2 megacycles is obtained on the main tuning and vernier dials on the front panel.

(13) Adjust the signal generator tuning dial until a maximum indication is obtained on the radio receiver tuning meter.

(14) Adjust the METER ADJ RF control in the radio receiver until an indication of 20 db is obtained on the radio receiver tuning meter.

(15) Rotate the RF GAIN control on the radio receiver counterclockwise to the OFF position.

(16) Insert the power line plug of Electronic Multimeter TS-505( )/U into the 115-volt, 60-cycle power source.

(17) Connect the black test lead to the COMMON binding post of the multimeter.

(18) Connect an alligator clip to the other end of the black test lead and clip the lead to one side of the 600-ohm resistor connected between the AUDIO OUTPUT terminals on the rear of the radio receiver.

(19) Connect an alligator clip to the a-c probe and clip the probe to the other side of the 600-ohm resistor.

(20) Set the RANGE switch on the multimeter to the 2V/R x 1 position.

(21) Set the FUNCTION switch on the multimeter to the A. C. position and allow 3 minutes for the multimeter to warm up.

(22) Rotate the AUDIO GAIN control on the radio receiver fully counterclockwise to the 10 position.

(23) Rotate the RF GAIN control on the radio receiver fully clockwise to the 10 position.

(24) Hold the METER switch in the AF position. Adjust the AUDIO GAIN control until an indication of 1. 9 volts is obtained on the multimeter. Adjust the METER ADJ AF control on the radio receiver until an indication of 0 db is obtained on the radio receiver tuning meter.

(25) Release the METER switch and rotate the RF GAIN control on the radio receiver counterclockwise to the OFF position.

c. Concluding Procedure

(1) Set the signal generator POWER ON-OFF switch to the OFF position and disconnect the antenna test cable from the radio receiver.

(2) Disconnect the power line plug of the signal generator from the power source.

(3) Disconnect the electronic multimeter test leads from the radio receiver and the power line plug of the multimeter from the power source.

(4) Disconnect the power line plug of the receiver from the power source.

(5) Remove the 600-ohm resistor from the AUDIO OUTPUT terminals on the radio receiver.

(6) Replace the top cover of the radio receiver and tighten the four thumb screws.

(7) Replace the radio receiver in the relay rack and tighten the eight holding screws to secure the radio receiver.

(8) Connect all the cables and wires to their respective terminals on the rear of the radio receiver.

(9) Insert the power line plug of the radio receiver into the 115-volt, 60-cycle power source.

# CLEANING AND INSPECTION - RADIO RECEIVERS SP-600-JX-21 AND SP-600-JX-17, 750-HOUR INSPECTION

## 1. GENERAL INFORMATION

a. The purpose of this routine is to clean and inspect the chassis and component parts of Radio Receiver SP-600-JX-21 or SP-600-JX-17.

b. The approximate time required to do this routine is 1 man-hour.

c. Report all defective items to the maintenance supervisor.

## 2. TEST EQUIPMENT REQUIRED

a. None

## 3. MATERIAL REQUIRED

a. Screwdriver

b. Clean, lint-free cloths

c. Brush, dry, 1 inch wide

d. No. 0000 sandpaper

e. Solvent, cleaning, trichlorethylene, MIL-T-7003

f. Vacuum cleaner

## 4. PROCEDURE

a. Rotate the RF GAIN control on the radio receiver to the OFF position.

b. Disconnect the power line plug of the radio receiver from the power source.

c. Disconnect the antenna cable from the antenna input connector.

d. Disconnect the loudspeaker from the AUDIO OUTPUT terminals.

e. Disconnect the BFO, IFO, RF, GND, DIODE OUTPUT and AVC connections from their terminals.

f. Remove the eight screws holding the radio receiver in the relay rack and remove the receiver from the rack.

g. Loosen the four thumb screws holding the top cover to the radio receiver and remove the cover.

h. Set the radio receiver on its side and remove the seven machine screws holding the bottom plate to the radio receiver. Remove the bottom plate.

i. Clean and inspect the radio receiver as follows:

(1) Clean the windows with lint-free cloths.

(2) Brush the dust from all front panel controls.

(3) Use a vacuum cleaner or dust brush to remove dust and dirt from the chassis.

(4) Moisten a lint-free cloth with solvent and wipe the radio receiver free of dirt and grease.

(5) Remove all traces of rust and corrosion on metal parts with No. 0000 sandpaper.

(6) Inspect the tube and crystal sockets and pins for loose contacts, dirt, and corrosion.

(7) Inspect the tubes for loose envelopes and proper seating in sockets.

(8) Inspect all fixed capacitors for leakage, bulging, and discoloration.

(9) Inspect all variable capacitors for bent or damaged plates, tightness of mounting, dirt, and moisture.

(10) Inspect all resistors, bushings, and insulators for cracks, chipping, blistering, discoloration, and dirt or moisture.

(11) Inspect the terminals of wire-wound resistors and fixed capacitors for loose connections and loose or broken lugs.

(12) Inspect the switches, transformers, chokes, potentiometers, and terminal boards for tighteness of mountings.

(13) Inspect the BAND CHANGE control for bent or broken "V" contacts.

(14) Inspect the terminal boards for loose terminals, cracks and breaks.

(15) Inspect the power transformer and the audio output transformer for loose mounting and overheating.

j. Replace the bottom plate on the radio receiver and tighten the seven machine screws.

k. Replace the top cover on the radio receiver and tighten the four thumb screws.

l. Replace the radio receiver in the relay rack and tighten the eight holding screws to secure the radio receiver.

m. Connect all cables and wires to their respective terminals on the rear of the radio receiver.

n. Connect the power line plug of the radio receiver into the 115-volt, 60-cycle power source.

Original Routines 3.1(1) and 3.2(1)
deleted

Original Routine 3.3(1) changed to
Routine 3.1(1)

# SP-600 - JX17

# COMMUNICATIONS RECEIVER

# FOR

# SINGLE AND DIVERSITY RECEPTION

## INSTRUCTION AND SERVICE MANUAL

THE HAMMARLUND MANUFACTURING CO. INC.

460 W. 34TH St. New York 1, N. Y.

SP-6CO-JX17

# COMMUNICATIONS RECEIVER

# INSTRUCTION AND SERVICE MANUAL

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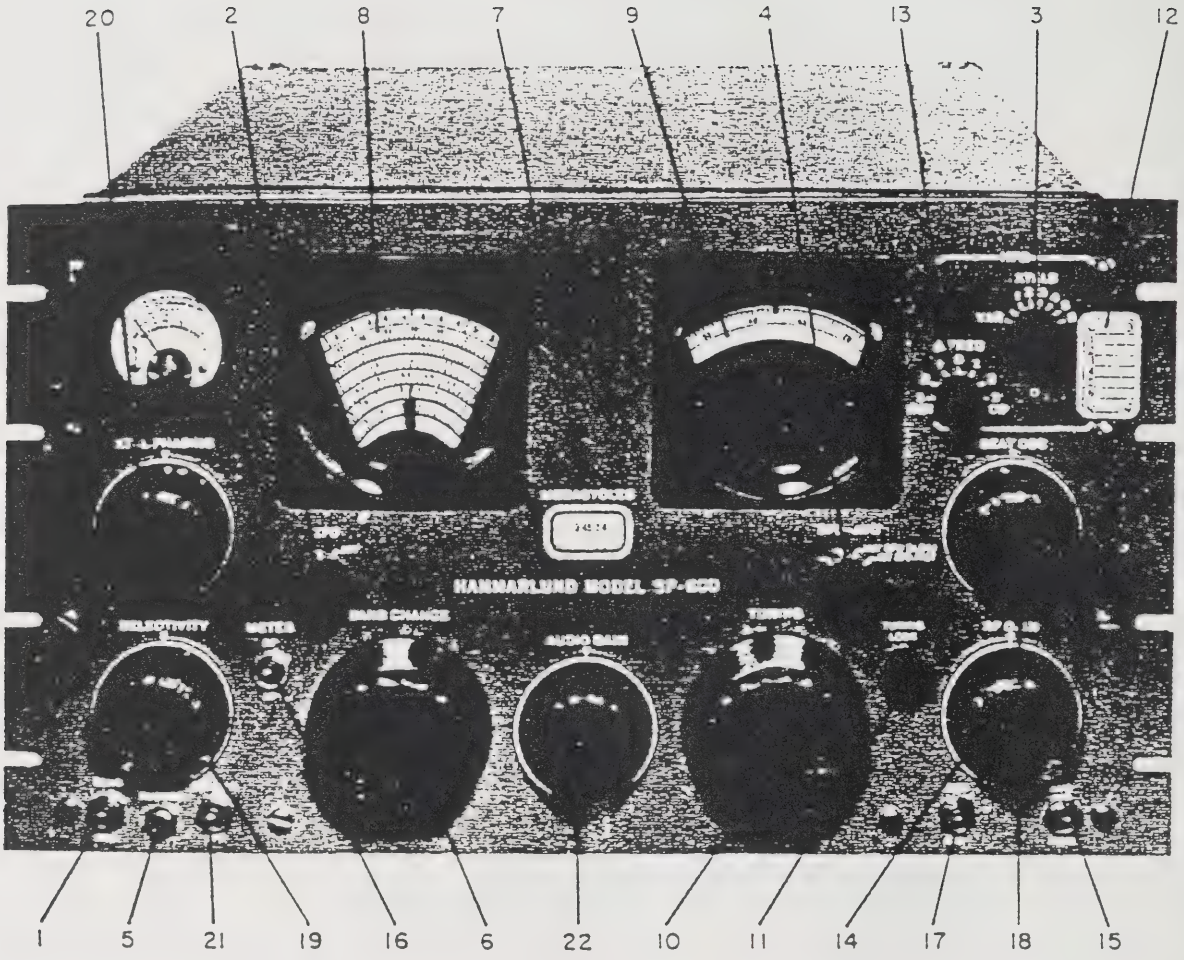



1. "SEND" "REC" switch
2. "IFO" "EXT" "INT" switch
3. "HFO" "VAR" "EXT" "XTALS" "1" "2" "3" "4" "5" "6" switch
4. "BFO-AVC" "EXT BFO" "SLOW" "FAST" "INT BFO" "SLOW" "FAST" switch
5. "PHONES" jack
6. "BAND CHANGE" control
7. "MEGACYCLES" window
8. Main tuning dial
9. Vernier dial
10. "TUNING" control
11. "TUNING LOCK"
12. Plastic chart
13. "HFO" "Δ FREQ" control
14. "RF GAIN" control
15. "AVC" "MAN" switch
16. "METER" "RF" "AF" switch
17. "MOD" "CW" switch
18. "BEAT OSC" control
19. "SELECTIVITY" switch
20. "XTAL PHASING" control
21. "LIMITER" "OFF" switch
22. "AUDIO GAIN" control

*Figure 1. Radio Receiver, Front Panel View*

## SECTION I

## INTRODUCTION

The SP-600-JX17 is a 20-tube superheterodyne radio communications receiver designed specifically for diversity reception. The receiver is intended for use as either the "master" or "slave" unit for the reception of MCW, CW, suppressed carrier, or frequency-shift signals.

"Master-slave" relationship is established by interconnecting two or more receivers. These connections may be made between the beat-frequency and/or the heterodyne oscillators of each receiver, or between the receivers and an externally connected master oscillator common to each.

Frequency drift, after a 15 minute warm-up, ranges between .001 percent and .01 percent of frequency, depending on the frequency used. This is an unusual degree of frequency stability for variable tuned RF oscillators and closely approaches crystal stability.

The frequency control unit provides for fixed channel crystal-controlled operation on any six frequencies within the range from .75 to 54 megacycles. Front panel controls permit the selection of either the normal high stability, continuously variable tuning or fixed frequency operation. For crystal-controlled fixed-channel operation, it is only necessary to set the dial to the signal frequency, switch to the crystal frequency desired, and tune with the delta frequency control. Desired crystals may be purchased on special order from the Hammarlund Manufacturing Company.

The selectivity control provides 3 degrees of crystal and 3 degrees of non-crystal selectivity ranging from sharp (.2 Kc) to broad (13.0 Kc). The crystal filter in the SP-600-JX17 embodies the same circuit features that have proved so effective and desirable in Hammarlund Super-Pro receivers.

Two stages of radio frequency amplification are provided on all bands: single conversion is used for signal frequencies up to 7.4 megacycles, and double conversion, employing a crystal-controlled oscillator, for signal frequencies above 7.4 megacycles.

Four stages of IF amplification, detector and AVC rectifier, noise limiter and meter rectifier, beat frequency oscillator and buffer amplifier, IF output, AF amplifier and output power stage, are among the features of the SP-600-JX17, which are discussed fully under separate headings in this manual.

The Audio output circuit is designed for a 600-ohm load or line and is provided with a four-terminal split winding for balanced load operation. Maximum power output is approximately 2.0 watts. The headphone circuit when referred to an 8,000-ohm resistive load provides signals attenuated approximately 15 db below the 600-ohm power output. Either headphones, loud speaker or both may be used for reception of signals.

The receiver i.f. output or audio-output, connected to a suitable frequency-shift receiver converter and associated teletypewriter, provides for recorded copy of a teletype signal. A CW signal may be amplitude-modulated by an external tone generator connected to the receiver, so that a steady, audible (monitoring) tone is always heard when the transmitter carrier is on the air, whether signal intelligence is present, or not.

A single tuning control of special design permits maximum traverse speed as well as exceptional operating ease. It controls both the main and vernier dials. The main dial, in addition to being frequency-calibrated, includes an arbitrary scale in

hundredths, while the vernier scale contains an arbitrary scale in units. These arbitrary scales, complemented by the anti-backlash gear train which governs dial movement, provide extremely accurate logging and resetability. A tuning lock assures positive locking action without affecting the frequency setting.

Radiation is negligible and complies with requirements for ship-board operation and for multi-receiver installations.

Although the antenna input circuit is designed for the coaxial cable connection of a wave antenna system, a conventional single wire antenna may be used.

The self-contained power supply of the SP-600-JX17 is designed for operation on a single phase 50 to 60 cycle alternating current power source. The power transformer primary is provided with terminals offering a range of line voltage from 90 to 270 volts.

The send-receive switch desensitizes the receiver but leaves the power on to provide for instant reception between transmissions.

The SP-600-JX17 is available as either a rack model, suitable for a mounting in a standard 19" relay rack, or as a cabinet model for table use.

## General

The electrical circuitry of the SP-600-JX-17 is shown schematically in Figure 9. A block diagram, Figure 2, is provided to illustrate the arrangement and functions of the various circuit sections. The location of the various tubes is shown in Figure 3. The circuit for single conversion, used for signal frequencies up to 7.4 megacycles, consists of two stages of RF amplification V1 and V2; First Mixer V5; First Heterodyne Oscillator V4; four stages of IF amplification, V7, V9, V10 and V11; Detector, AVC Rectifier V14; Noise Limiter V15; Beat Frequency Oscillator V13; IF output and AF amplifier, V16A and V16B; Output Power Stage V17, and the Power Supply System which includes B Power Rectifier V19, C Bias Rectifier C20 and Voltage Regulator V18.

In the circuits for double conversion, used for signal frequencies above 7.4 megacycles the Second Mixer V6 and Second Heterodyne Oscillator V8 are substituted for the gate tube V7.

A precise rotary turret is used to change bands. It associates the RF tuner, sub-assemblies of the antenna coupling, the two-stage RF amplifier, and the first heterodyne oscillator of the band selected with the circuitry in the RF strip common to each band. In this way, each RF tuner sub-assembly is positioned directly adjacent to its respective tube and gang section of main tuning capacitor C1A-C1H.

Input Coupling - The antenna input coupling provides an optimum match for a 95-ohm coaxial cable line connected to antenna input connector V1. On bands, 1, 2, 3, and 4, the antenna RF transformer is secondary-tuned by dual section C1A-C1B of the main tuning capacitor; on bands 5 and 6, by section C1A only. A capacitor, such as C3 for band 1, is used so that the antenna circuit tracking matches that of the RF amplifier.

RF Amplifier - The V1 and V2 stages of the RF amplifer are identical. V1 is secondary-tuned by dual section C1C-C1D while V2 is secondary-tuned by dual section C1E-C1F of the main tuning capacitor. Complexed coupling is used in RF stages to maintain a more constant level of signal gain over the frequency levels of each band. High image rejection ratios are achieved through the use of three High Q tuned RF circuits and by double conversion on the three higher frequency bands. The high gain developed by two RF stages assures maximum sensitivity at high signal-to-noise ratios.

First Heterodyne Oscillator (variable V4) - First Heterodyne Oscillator V4 functions as a Colpitts oscillator for the three higher frequency bands and as a tuned-grid oscillator for the three lower frequency bands. Dual section C1G-C1H of the main tuning capacitor provides for the variable tuning of the oscillator. For single conversion, the oscillator frequency is 455 Kc higher than the signal frequency, while for double conversion the oscillator frequency is 3.955 mc higher than the tuned-in signal.

First Heterodyne Oscillator - (Crystal Controlled V3) - For services requiring extremely stable, fixed-frequency operation, a crystal controlled high frequency oscillator is provided. Instant change-over from variable to crystal controlled oscillator with a choice of six crystal positions is effected by a front panel XTALS control. A second front panel control marked Delta Frequency permits a tolerance adjustment of the crystal oscillator frequency over the ± .005% (purchased crystal tolerance) range.

For double conversion, the conversion oscillator output from V3 is augmented b V4.

Conversion oscillator output from V3 is availablt at HFO output connector socke J8 at the rear of the frequency control unit when the front panel control is in a crystal position; but when the front panel control is set to its EXT position, the conversion oscillator voltage for the receiver is that which is externally connecte to J8.

Intermediate Frequency Amplifier - Single conversion to 455KC is employed for signal frequencies below 7.4 mc. There are four stages of IF amplification incorporating the Hammarlund - patented filter circuit. Six positions of selectivity provide 6 db bandwidths of .2, .5, 1.3, 3, 8, and 13 kc. On the three narrower bandwidth positions the crystal filter is in operation. The crystal phasing control provides extreme selectivity for the high attenuation of closely adjacent interfering signals. Double conversion is employed for signal frequencies above 7.4 mcs. The signal is heterodyned to 3.955 mc by the First Mixer V5 and Heterodyne Oscillator V4, or V3 for high image rejection. The 3.955 mcs signal is then heterodyned to 455 KC by the Second Mixer V6 and the 3.5 mc Fixed Crystal-Controlled Oscillator V8 for selectivity. For double conversion, the tuned circuits and the 3.955 mc IF transformer T2 assure appropriate input to the Second Mixer V6. IF transformer T1 in the plate circuit of V5 is resonant to both 455 kc and to 3.955 mcs. For single conversion, the 455 kc signal path is to 455 kc IF gate V7; for double conversion, the 3.955 mc signal path is to Second Mixer V6. The prime function of V7 is to render the signal path through it an open circuit for double conversion and available to the signal for single conversion.

The 3.5 mc crystal-controlled heterodyne output from V8 is available at IFO connector socket J6 at the rear skirt of the receiver, when the front panel IFO switch is set to its INT position; but when the IFO switch is set to its EXT position, the 3.5 mc conversion oscillator for the receiver is that externally connected to J8, since V8 is now inoperative.

Detector and AVC - The V14 tube is used as a high level Detector and AVC rectifier. The AVC circuit is provided with separate time constants for CW and MCW operation. AVC and Diode output terminals provide for connections in diversity applications. The AVC bias developed is applied to V1, V2, V6, V7, and V9, but the bias to V1 and V2 is reduced through use of a voltage divider network (resistors R48 and R53).

The BFO-AVC switch provides choice as to a FAST or SLOW time constant. Since the switch functions also as a BFO switch, two positions, BFO FAST and BFO SLOW, are provided.

Beat Frequency Oscillator - The beat frequency oscillator employs a high capacity Colpitts circuit which provide a high order of frequency stability and minimizes oscillator harmonics. The Beat Frequency Oscillator V13, is coupled into the detector circuit through Buffer Amplifier V12, which eliminates oscillator lock-in. A front panel control varies the audio-beat frequency from zero beat to ± 3 kc.

The beat frequency oscillator output from V13 is available also at BFO connector socket K7 at the rear apron of the receiver when the front panel BFO switch is set to either its FAST or SLOW INT BFO positions; but when set to either of its FAST or SLOW EXT BFO positions, the functioning beat frequency oscillator for the receiver is that which is externally connected to J7, since the output from V13 is suppressed.

Front panel switch control MOD-CW renders V13 operative for CW operation. An external switch control connected to terminals BF of remote connector socket

AN3102A-14S-2S (J4) on the rear skirt may also be used to perform this function, since these terminals are in parallel with the contacts of the control switch.

Alternate to the use of the beat frequency oscillator to render a keyed-carrier CW signal intelligible, a local tone generator may be externally connected to terminals A and B of J4 to amplitude modulate the CW signal. The use of a local tone generator produces a steady tone even when the received carrier frequency drifts. J4 is furnished with connector plug A and 3108B-14S-2P and cable clamp AN3057-6.

Noise Limiter - The noise limiter circuit V15 limits the noise interference from ignition systems or other sources of pulse-type noise. A separate limiter control switch permits optional use of the limiter on any mode of operation when pulse type interference is present.

Audio Frequency Amplifier - A resistance-coupled amplifier triode V16B amplifies the audio-frequency signal from the detector.

Audio Output - The audio output to V17 is transformer-coupled through a split balanced winding to deliver 2.0 watts undistorted output to a 600-ohm load. The split balanced winding permits balancing of the direct kind in the output circuit, as used for teletype or similar service. A separate secondary winding provides attenuated audio signal output for headphone operation. This winding will deliver an output of 15 milliwatts into an 8000-ohm resistive load when the 600-ohm power secondary is delivering 500 milliwatts to a 600-ohm resistive load.

IF Output - A cathode follower, the V16A provides a 70-ohm impedance source of intermediate frequency (455kc) to socket SO-239 on the rear skirt of the chassis. Plug PL-259, and angle plug adapter M-359 used with coaxial cable RG-11/U are not supplied.

Power Supply - The power supply is an integral part of the receiver. It includes the B rectifier V19 and C rectifier V20, together with their respective low-pass filters and Voltage Regulator V18. The power transformer is provided with screw terminal primary taps, covering a power line source range of 90 to 270 volts, 50 to 60 cycles. The power transformer and filter components are protected by fuses in the primary and plate supply circuit.

Tuning Meter - The tuning meter is used on AVC operation to indicate the accurac of tuning and the relative strength of received signals. Depression of the Meter Switch converts the meter circuit for indication of output level in db from 6 milliwatts.

RF Gain Control and Power Switch - The RF gain control is provided for manual control of sensitivity to prevent overloading on strong signals when operating with the AVC-MANUAL switch in the "MANUAL" position. This control also operates when the switch is in the "AVC" position. The Power "ON-OFF" switch is operated at the counter-clockwise extremity of the RF gain control.

Send-Receive Switch - The send-receive switch desensitizes the receiver but leaves the power "on" to provide for instant reception between transmission periods.

Radiation - Advanced design and shielding of the high frequency, second conversio crystal and beat frequency oscillators has reduced radiation to a negligible point so that interference of this nature, common in multi-receiver installations, is reduced to a minimum.

## SECTION III

## INSTALLATION

Tubes and Packing - After unpacking the receiver see that all tubes are firmly in their sockets and that all packing material is removed from the receiver.

Power Supply - Make sure that the primary tap lead at the bottom of the power transformer is connected to the tap which most nearly agrees with the 50 to 60 cycle power source voltage. Power connector plug AN3108B-18-3S with cable clamp AN3057-10 with power cord and plug are furnished with the receiver.

Antenna - The input impedance at the antenna socket, SO-239, is designed to match a 95-ohm coaxial cable line. The plug connector PL-259, and angle plug adapter M-359, supplied with the receiver, are for use with RG-11/U coaxial cable (not supplied).

Speaker - The speaker should be of the permanent-magnet dynamic type and should include a speaker voice coil to 600-ohm line-matching transformer for connection to the 600-ohm audio output terminals of the receiver. Caution: When the 600-ohm output is not used connect a 600-ohm, 2-watt resistor to these terminals to avoid component damage from high transient peak voltages. For applications requiring the insertion of direct current control or indicating voltages, the jumper connecting the two balanced sections of the 600 ohm-output may be removed and the insertion circuit, such as a low resistance balancing potentiometer, connected in its place.

Headphones - Either high or low impedance headphones may be used by plug connection to the phone jack located at the lower left side of the front panel. The high impedance type is recommended.

Mounting - The receiver is designed for rack mounting. Top and bottom cover plates are supplied for mounting in a standard 19-inch rack. The panel is $10\frac{1}{2}$ inches high. See Section VII. The receiver should be placed in a position which permits the free access of air.

Crystals for Frequency Control - Crystals Y1 to Y6 are not supplied with the receiver, but will be supplied on special order for any signal frequency within the range of from 2 to 30 megacycles. In order to insure correct crystal-controlled frequency operation, crystal units may be ordered from THE HAMMARLUND MFG. CO. INC. The order should specify the signal frequency for which each unit is to be used. See note at end of Table 5. To install crystals loosen the knurled thumb screw on top of the Crystal Control Unit T34 and push to the rear. Insert the crystals in the sockets. Bring the retainer spring assembly forward so that the springs press on top of the crystal holders, and tighten the thumb screw. Mark the signal frequency for which each crystal was selected in megacycles on the plastic chart provided for this purpose alongside the crystal switch S2. Pencil or ink may be used and can be erased if it is desired to change these figures at any time. The numerals on the chart should be used so that they agree with the numerals on the crystal socket positions, which are also indicated by the crystal selector switch.

Relay Connections - If external relay operation for the send-receive function is desired, connection may be made by soldering a twin conductor cable to the terminals of the Send-Receive switch S9. In this case S9 is left in the Send or Open position.

AVC and Diode Output - In diversity applications, the diversity feature is accentuated by interconnecting the AVC (-) bus between receivers, and utilizing a

common ground (G) connection. This AVC connection is made when the IF or AF output of the system is used to provide for the intelligence due to a CW, MCW, or frequency-shift signal; but for voice signals only the audio output from one receiver is used. This is done by removing the DIODE OUTPUT jumper on each receiver apart from one; and connecting the negative (-) terminal of each to that of the one whose terminals remain jumpered.

IF Output - The IF output socket SO-239 at the rear skirt provides the signal at 455kc for diversity receiving system use. Connector plug PL-259 and angle plug adapter M-359 (supplied) should be used with RG-11/U coaxial cable (not supplied). The output provided to a 70-ohm resistive load is approximately 200 millivolts for normal sensitivity (2 microvolts input signal).

Master Slave Connections - In diversity applications the monitoring requirements imposed on the operator are severe, but may be kept at a minimum by use of common conversion and beat-frequency oscillators. Then the operator need concern himself mostly with the signal level in each channel and the signal tuning of the receivers.

To provide for V-3 crystal-controlled first heterodyne, and/or V-8 3.5 mc. crystal-controlled heterodyne, and/or V-13 beat-frequency oscillator output, respectively, from the master to the slave receiver, the HFO, IFO, and BFO sockets SO-239, at the rear skirt of each, furnished with plug PL-259, and angle plug adapter M-359 for IFO and BFO only, are interconnected. The coaxial cable RG-11/U suited for use is not supplied.

With the red front panel controls in each instance on one receiver set to a red panel marking, that receiver becomes the slave receiver, wherein its V-3 (HFO), V-13 (BFO) and its V-8 (IFO) are rendered inoperative.

Remote Connector - The REMOTE connector J4 is furnished with connector plug AN 3108B-14S-2P and cable clamp AN 3057-6. Use terminals A and B of J4 for connecting a local external tone source to modulate a CW signal and use terminals C and D of J4 to perform the function of the CW-MOD switch by another system panel switch, if desired.

## SECTION IV

## OPERATION

General - Before attempting operation of the SP-600-JX17 receiver, the operator should thoroughly familiarize himself with the functions and uses of the various controls. When referring to the controls in this description, the words in capital letters represent the part of the name adjacent to the control on the front panel or on the rear skirt of the chassis. For example, when referring to the SELECTIVITY control, the word, SELECTIVITY in capitals indicates the legend appearing adjacent to the control. Reference to photographs, Figs. 1 and 6, is suggested while reading this description. Front panel controls and dials are shown in Fig. 1 and rear controls and terminals are shown in Fig. 6.

Selectivity Control - The SELECTIVITY control is a 6-position switch which selects three crystal and three non-crystal degrees of selectivity, ranging from extremely sharp for CW reception to broad for good fidelity MCW operation. The SELECTIVITY control dial indicates the 6 db bandwidth at each setting.

Phasing Control - The CRYSTAL PHASING control is a differential type, variable air capacitor. It permits adjustment of the crystal selectivity characteristic for high attenuation of closely adjacent channel interference on either side of the signal frequency.

RF Gain Control - The RF GAIN control varies the overall gain of the receiver. This control is operative in either position of the AVC-MAN switch.

Power Switch - The power, or "on-off" switch is combined with the RF GAIN control. Complete counter-clockwise rotation of the RF GAIN control throws the power switch to the "off" position, as indicated on the RF GAIN control dial.

Audio Gain Control - The Audio Gain control varies the input voltage to the audio amplifier. This control is also operative in either position of the AVC-MAN switch.

Phone Jack - The PHONES jack is a single circuit jack operating with the sleeve grounded and is suitable to receive any standard single circuit phone plug. It is in the circuit at all times and is connected to a separate secondary winding of the audio output transformer, which provides an attenuated signal for headphones. See Section III, Installation.

Audio Output - The AUDIO OUTPUT is available at the four-screw terminal board at the rear of the chassis for connection to a 600-ohm load. See Section III, Installation.

Noise Limiter - The LIMITER control switches the noise peak limiter in or out of the circuit. This control is operative independently of any position of any other control. See Section II, Circuit Description.

AVC-Manual Switch - In the AVC position the AVC-MAN switch applies automatic bias potentials to the controlled RF and IF amplifier tubes, thereby holding the audio output relatively constant over a wide variation in the strength of received signals. This minimizes the variation of output due to fading of the received signal and prevents blasting and overloading when tuning through signals of greatly different strength while traversing a frequency band. In the AVC position the RF Meter circuit is operative for indication of tuning resonance and relative strength of received signals. The RF GAIN control is operative on AVC operation when necessary

to control exceptionally strong signals or to reduce noise, but the RF meter is less effective when the RF GAIN control is below maximum setting. In the MAN position the AVC potential is removed from the controlled tubes and the gain of the receiver is manually controlled by the RF GAIN control.

CW-Modulation Switch - The CW-MOD control in the CW position energizes the beat frequency oscillator. In MOD position the beat frequency oscillator is inoperative and the conditions are established for either voice modulated or tone modulated signal reception.

Beat Frequency Oscillator - The BEAT OSC control varies the tuning of the 455 kc Beat Frequency Oscillator over a range from zero beat to plus or minus 3 kilocycles.

BFO-AVC Switch - The BFO-AVC control in either the EXT BFO SLOW or INT BFO SLOW positions connects an additional timing capacitor to the AVC circuit to accommodate the AVC circuit to automatic CW keying, as compared to either the EXT BFO FAST or INT BFO FAST positions, effective for MCW and frequency-shift reception. In either FAST or SLOW INT BFO positions, the internal BFO of the receiver is operative when the CW-MOD switch is at CW. In either FAST or SLOW EXT BFO positions, the BFO source connected to the BFO connector at the rear skirt is used by the receiver.

IFO Switch - The IFO switch in the INT position renders the internal 3.5 mc crystal-controlled conversion oscillator operative. In the EXT position the oscillator is inoperative, since the IFO of the master receiver (externally connected to the IFO connector at the rear skirt) is used.

Send-Receive - The SEND-REC control is a single-pole single-throw toggle switch. In the SEND position it desensitizes the RF amplifier, gate, second mixer and 3.5 mc oscillator tubes during transmission periods.

Tuning Control and Dials - The TUNING control rotates the main tuning capacitor as well as the main and vernier tuning dials. The main dial has six frequency band scales, calibrated in megacycles, and an arbitrary outer scale. The vernier dial has an arbitrary 0 to 100 scale. The numeral under the upper or fixed pointer of the main dial indicates the number of complete revolutions that have been made by the vernier dial at any setting. Thus, if the pointer for the outer scale of the main dial indicates over the figure "4" and the vernier dial indicates 87.6, the reading to log for this setting is "487.6". This precise mechanical vernier system divides the rotation of the main dial over each frequency band into approximately 600 vernier divisions, with one-half division calibration points. Since it is easy to estimate one-tenth divisions on the vernier scale, this divides each frequency band into approximately 6000 readable settings, providing extreme accuracy in the logging and resetting of stations.

Tuning Lock - The TUNING LOCK, located to the right of the TUNING control, provides a positive lock for the tuning mechanism without affecting the frequency setting when it is desired to prevent accidental shifting of the tuning.

Band Change - Each revolution of the BAND CHANGE control turns the turret, containing the RF and HF Oscillator coil, trimmer and switch contact assemblies, from one frequency band to the next. The turet has no stops and may be turned in either direction. A positive detent mechanism assures correct location of the various bands. The BAND CHANGE control simultaneously operates the small MEGACYCLES band indicating dial, located at the center of the panel and aligns the dial frequency indicator with the proper scale of the main dial.

Crystal Controlled HF Oscillator - The XTALS control selects one variable high frequency oscillator operation, any one of the six crystal positions. Correspondingly

numbered crystal sockets are provided in the Crystal Control Unit. In its EXT position, the crystal-controlled first conversion oscillator source is connected to the HFO connector at the rear skirt. See Section III Installation. The DELTA FREQ control compensates for the small crystal frequency tolerance.

Meter Switch - The METER switch is a double-pole, double-throw toggle switch with spring return to the RF position. See Section II, Circuit Description, Tuning Meter.

Tuning Meter Controls - The METER ADJ RF control is used to adjust the resistance shunting the meter when the METER switch is in the normal, or RF position. It is adjusted to produce a reading of plus 20 db on the RF scale of the meter, with a 10 microvolt RF input signal and with the AVC-MAN switch in the AVC position. Depression of the METER switch to the AF position converts the meter circuit for indication of the AF power output level in db from 6 milliwatts. This switch is spring-returned to the RF position when released and should not be depressed for the AF scale unless the audio output has been adjusted for low power output by means of headphones or speaker. Failure to observe this precaution may result in damage to the meter. The meter ADJ AF control is used to regulate the meter current when operating on the AF scale. This control is adjusted to obtain a 0 db reading on the AF scale of the meter and is made with the audio power output from the 600-ohm AUDIO OUTPUT terminals adjusted to 6 milliwatts, or 1.9 volts across a 600-ohm resistive load.

Preliminary to Operation - Turn the power switch "on" by turning the RF GAIN control clockwise and advance this control to "10". Note that the dial lamps light. Place the SEND-REC switch on REC and turn the BAND CHANGE control to the frequency band in which it is desired to operate. This should be done at least 15 minutes before using the receiver in order to permit the tubes to warm up. Insert the headphones plug in the PHONES jack or use speaker as desired. See Installation, Section III.

MCW Reception - Turn the TUNING LOCK to its extreme counter-clockwise position and turn the SELECTIVITY switch to 3 kc. Put the CW-MOD switch on MOD, the LIMITER switch to OFF, the AVC-MAN switch on AVC, the XTAL PHASING control at its center position and turn the XTALS switch to VFO. With the BAND CHANGE control in the proper position for the frequency band desired, as indicated by the MEGACYCLES dial, advance the AUDIO GAIN control until some noise is heard. Turn the TUNING control to indicate the desired frequency on the main dial and tune the signal for maximum response or indication on the RF Meter. At resonance the main dial reading should be within one-quarter of one percent of the signal frequency. Re-adjust the AUDIO GAIN control for the desired output level and as required to prevent overloading. Carefully tighten the TUNING LOCK by turning clockwise, if desired. The SELECTIVITY switch may be turned to the 8 kc or 13 kc position for improved high frequency response if the signal-to-noise ratio is sufficiently high. If the noise level is high, the SELECTIVITY switch should be turned to the bandwidth which provides the most intelligible reception and the LIMITER switch should be thrown "on". If the SELECTIVITY switch is used on one of the XTAL positions, the XTAL PHASING control may be adjusted to either side of its center position to attenuate an adjacent interfering signal. The RF GAIN control may be turned down somewhat to reduce noise during stand-by periods in the transmission when traversing the tuning range, or during deep fades of the signal. The RF Meter scale calibration is for maximum RF GAIN control operation and indicates only when the AVC-MAN switch is on AVC. When searching for very weak signals the CW-MOD switch may be thrown to CW and the BEAT OSC control set at "0". Locate and tune the signal to obtain zero beat and then throw the CW-MOD switch back to MOD.

The Crystal Frequency Control may be used for fixed-frequency operation at any

signal frequency for which crystals have been provided. See Section III, Installation. Turn the XTALS switch to the numeral corresponding to that on the panel chart for the desired signal frequency. Set the main tuning dial to the signal frequency and adjust the Δ FREQ control to obtain zero beat with the CW-MOD switch on CW and the BEAT OSC control at "0". Throw the CW-MOD switch to MOD and adjust the TUNING control for maximum RF Meter indication or for maximum response.

CW Reception - The preliminary procedure for CW reception is the same as for MCW reception above. Place the CW-MOD switch on CW and with the BEAT OSC control at "0", tune the desired signal for zero beat. Adjust the BEAT OSC control, in either direction, to obtain the audio pitch desired. The AVC-MAN switch may be used in the position which gives the best reception. Adjust the desired output level by the AUDIO GAIN control when on AVC and by the RF GAIN control when on MAN. The RF Meter does not operate on the MAN position. The SELECTIVITY switch may be used in the XTAL positions, as found desirable, to reduce noise or to provide rejection of an interfering signal. The XTAL PHASING control is adjusted for minimum interference from an adjacent, interfering signal. If interference of this kind persists, further discrimination between the desired and the undesired signals may be realized by slightly detuning the desired signal to the opposite side of resonance from that on which the undesired signal is located and readjusting the XTAL PHASING control and the BEAT OSC control for the desired signal. The Crystal Frequency Control may be used as described under MCW Reception above.

If reception is to be suspended and resumed at short time intervals, the power should be left "on" and for such operation the SEND-REC switch should be thrown to SEND between reception periods. This keeps the receiver warm and ready for instant use.

When operation of the receiver is completed, turn the power "off" by extreme counter-clockwise rotation of the RF GAIN control.

## SECTION V

## MAINTENANCE

General - This receiver is designed for continuous duty and should normally require little attention beyond the replacement of tubes. An occasional cleaning of the gear teeth in the gear train is recommended to prevent a heavy accumulation of dust which may cause calibration error and improper operation of the gears. This may be done with a small stiff bristle brush, turning the controls to obtain access to the different portions of the gears. No grease or oil should be used on the gears. Operation and maintenance of the receiver will be greatly facilitated if the contents of this instruction book are thoroughly digested.

Some sectionalizing of faults is possible, if the fault is not existent on all of the frequency bands. Non operation of only the three lower frequency bands, indicates that the fault is associated with the circuits of tube V7. If only the three higher frequency bands are affected, the fault is associated with the circuits of V6 or V8. If only one single band is affected, refer to HF Oscillator and RF Coil Assemblies in this section.

Visual evidence of trouble is usually a burned or darkened resistor, which is usually the result of excessive current due to a short circuited capacitor or tube element on the load side of the resistor. In such a case, the short circuited capacitor or tube and the resistor should be replaced as indicated. Refer to Figures 7 to 12 and Table 5 for location and values of components. If the checks on tubes, fuses and visual inspection fail to disclose the fault, the tube socket voltages and resistances should be measured and checked against the value given in Tables 1 and 2. Any appreciable departure beyond a normal variation of approximately 15 percent from the values in these tables will generally indicate the component or circuit at fault. If the foregoing does not reveal the fault, then a stage by stage check of amplification should be made as shown in table 4. Any great difference from the values of input shown in the table will indicate the stage at fault. If a tuned circuit component, such as an IF transformer, RF or IF oscillator coil assembly is found defective, only the replaced unit need be realigned. Follow the alignment procedure in Section VI, for the unit involved.

The IF Transformers, Crystal Filter, Beat Frequency Oscillator and the 3.5 mc Crystal Controlled Oscillator assemblies are mounted on the chassis, independently of their respective shields. The shield can assemblies are easily removed for inspection of these units, without disturbing the soldered connections. When replacing these shields, make sure that the grounding springs are in place on the inductance adjuster screws before the shield is installed.

Vacuum Tubes - Weak or defective vacuum tubes are the most common cause of decrease in sensitivity, faulty performance or failure of operation in a receiver. In case of such faults, first remove the tubes and check them in a tube tester of reliable design. If a tube tester is not available, substitution of a new tube for each tube type and position should be tried. See Figures 2 and 3. Such substitution is best made, one tube at a time in order that the faulty tube may be detected by the improvement or restoration of performance by the new tube.

Locating Faults - If the dial lamps do not light when the power switch is turned on, check for a blown line fuse, F1 and replace it at the rear of the receiver from the spare fuses. If the dial lamps light but there is no sound at all in the headphones or speaker, check for a blown, minus B fuse, F2. If blown, replace. In replacing fuses, make sure that only a 1.6A Fusetron is inserted in the line fuse holder and that only a 3/8 ampere fuse is inserted in the minus B fuse holder.

Should neither fuse be blown, or if replacement of the fuses does not restore operation, the receiver should be removed from its rack and inspected for visual signs of trouble. The rack model receiver is provided with bottom and top cover plates which should be removed for purposes of inspection and repair.

IF Transformers - If a fault is traced to one of the variable coupled IF transformers, T4 or T5, check whether the fault exists on all positions of the selectivity switch S5, or only on one position of this switch. If the faulty operation occurs on only one switch position, check for continuity of the coupling coil associated with that position, check for imperfect soldered connections at the coil and switch terminals and check the switch contact involved. If faulty operation localized at one transformer exists on all positions of the selectivity switch, make the continuity check on the plate coils, on the main grid coil and on the wiring associated with these coils. Transformers T4 and T5 and Crystal Filter T3 have additional inner shield assemblies that are held in place by the tension nuts on the adjusting screws. To remove these shields, hold the adjusting screw with a screw driver to prevent turning the screws and losing the alignment adjustment and loosen the tension nuts, using another small screw driver engaging one of the slots. When replacing these shields and tension nuts, employ the same method and tighten the tension nuts just enough to prevent the adjusting screws from working loose.

Beat Frequency Oscillator - To remove the beat frequency oscillator T6, it will be necessary to set the crystal selector switch S2, on its number 3 position and loosen the four set screws in the rigid shaft coupling and the two set screws in the disc on the selector switch shaft. Slide the switch shaft forward through the coupling and disc. It may be necessary to remove burrs, caused by the set screws, from the switch shaft in order to slide the shaft through the disc. Now loosen the four set screws of the flexible coupling on the BFO shafts and slide the coupling forward on the BFO drive shaft in the front panel. Remove the BFO shaft bearing bracket by taking out the two screws holding it to the chassis. Unsolder the leads from the six terminals of the BFO unit at the underside of the chassis. Be careful to avoid overheating the wire of the shielded cable since this wire is insulated with polystyrene and is easily damaged by heat. Note that if this cable wire is grounded to its shield, there will be no beat frequency voltage input to the buffer tube V12 even though the beat oscillator is functioning properly. Therefore, with the shielded lead disconnected from the lug of the BFO unit, check with a continuity or ohmeter the connection of this wire to the buffer tube V12 and its freedom from the chassis. Carefully observe the wiring of the BFO unit for correct replacement. See T6 on Figure 12. Now remove the two screws holding the BFO shield can to the chassis and the two screws at the underside of the chassis and remove the BFO unit. When replacing the unit, follow the reverse procedure. Before tightening the two screws holding the unit to the chassis and the two screws holding the shaft bearing brackets, adjust the unit and shaft brackets to obtain alignment of the two shafts at the coupling. Make sure that the shield grounding spring is in place, with the bow of the spring downward against the tension nut, before replacing the shield can assembly.

Adjustment of BFO - With the AVC-MAN switch on AVC, and the SELECTIVITY control on the .2 kc position, tune in an unmodulated signal for maximum tuning meter reading. Set the CW-MOD switch to CW and with the BEAT OSC dial at 0, adjust the top screw of the BFO unit for zero beat. Turn the BEAT OSC dial to each 3 kc position and check the output beat frequency against a known audio frequency source such as a good audio oscillator. If the beat frequencies obtained at each 3 kc position is not within the range between 3 and 3.5 kc, loosen the set screws of the BFO shaft coupling and turn the shaft of the BFO with respect to the drive shaft and repeat the above, resetting the 0 adjustment by the top screw of the BFO unit each time until the above range is realized. One set screw should be used just tight enough to allow the drive shaft to operate the BFO shaft until the range is correct and then tighten both screws.

Crystal Switch Adjustment - If the mechanical drive of the crystal control switch has been disturbed, it should be adjusted as follows: Carefully slide the switch shaft through the disc and into the rigid coupling and, being careful not to turn the switch, tighten the four set screws in the rigid coupling, with the knob indicator on the number 3 position as originally set under Beat Frequency Oscillator. Now set the crystal switch on the number 1 position and, holding the disc in a counter-clockwise direction so that the end of the slot in the disc is against the drive pin, lightly fasten the set screws of the disc. When this disc is properly adjusted on the shaft, with the switch in the number 1 position, the connecting bar between the two discs should not be under tension and should exhibit a slight amount of play when tried with the thumb and forefinger. When so adjusted, tighten the set screws.

Crystal Control Unit - If it has been determined that the Crystal Control Unit is defective, it will be necessary to remove the unit for repair or replacement. Refer to Figure 11 and 12 and unsolder the lead of resistor R71 from switch S3 on the gear plate. Unsolder the black, black-white, blue-red and red-white leads of the crystal control unit from terminal strip E13 underneath the chassis and unsolder the red lead of the unit from filter capacitor C161. Remove the XTALS switch shaft, as described under Beat Frequency Oscillator. Loosen set screws and remove the delta C control knob. Remove the nut and lockwasher at the top of the bracket post adjacent to the power transformer and remove the bracket over the filter chokes. The front end of this bracket is slotted and engages a groove in a mounting post of the crystal control unit. Remove the four screws that secure the filter assembly panel to the mounting posts at each corner of this panel and move the filter assembly sufficiently to permit removal of the four screws holding the crystal control unit to the chassis. When these screws are removed, the unit may be taken from the receiver. In removing the unit and in subsequently handling it, be careful to avoid strain on the delta C shaft, or the delta C capacitor may be damaged. Remove the four screws holding each of three sides of the cover and spring the two top ends of the cover enough to make the flanges clear the top of the box. Hold these flanges apart to prevent their edges from damaging the RF chokes in the unit while sliding the cover off the crystal unit box. When the unit is to be replaced, follow the reverse of the above procedure. Follow the procedure under Crystal Switch Adjustment to properly reinstall the switch mechanism.

HF Oscillator and RF Coil Assemblies - If faulty operation occurs in only one frequency band of the receiver, the trouble should be found in one of the four coil assemblies for that band in the tuning unit turret. For example: Coil assemblies T13, 19, 25 and 31 should be examined if band 7.4 to 14.8 mc only, does not perform normally.. To remove these coil assemblies stand the receiver on its right or left side and remove the bottom cover plate from the tuning unit. Turn the band change control to place the band in question in its normal operating position and then turn the band change control two and one-half revolutions counter-clockwise. This will place the band coil assemblies parallel and at the bottom of the tuning unit. Now remove the two springs holding one coil assembly in the turret and carefully remove it by sliding it towards you and off the tongues of the shields. It is best to remove only one coil assembly at a time and inspect it for defects or substitute a replacement assembly if available. Caution: Make sure that the coil base is firmly seated and secured by its retaining springs before going to the next assembly or turning the band change control. Failure to do this may damage the switch spring contacts beyond repair. Repeat this procedure until the faulty assembly is found. In checking these assemblies, first check for continuity of the coils, particularly the small primary coils as in the RF Input assemblies, which are liable to damage if the receiver is operated in the presence of very strong transmitter signals. In replacing these coil assemblies be careful that the end of the assembly nearest the coil is toward the front of the receiver.

Mixer Plate Coil Assembly - Trouble in the Mixer Plate Coil Assembly T1, is indicated if the input required at pin 7 of V5 is found to be greatly different than the values shown in Table 4, and the gain from pin 7 of V6 is normal. To obtain access to the components of the mixer plate coil assemblies it is necessary to remove the crystal control unit and the filter assembly as described under Crystal Control Unit. The cover plate and shield of T1 may then be removed for replacement of a defective component. If the entire assembly is to be replaced, it will be necessary to unsolder all of the leads at both the bottom and top terminal boards of the unit. Refer to Figure 11 for components and wiring of T1.

RF Tube Platform - If the receiver fails to perform normally on any of the six frequency bands and the previous tests indicate that performance of the IF and audio frequency amplifiers is normal, (including the gain check in accordance with Table 4 for the input to pin 7 of V5) the fault is indicated to be in the RF Tube Platform or in the main tuning capacitor. Before removing the RF Tube Platform, it is advisable to remove the top shield cover and inspect the main tuning capacitor connections. Refer to Figures 8 and 11. Observe that the tuning capacitor is operating properly when the tuning control is rotated. Using a miniature tube adapter, see Section VI alignment, apply a modulated rf test signal successively to pin 1 of V1 and V2 and to pin 7 of V5. For each of these positions of the adapter and signal, tune through the proper dial setting for the signal frequency used. Gain of the order of 5 or 6 should be indicated for each stage and loss of signal will indicate the section to be investigated for the fault. No signal output, when the input signal is applied to pin 7 of V5, will indicate trouble in the RF oscillator section of the unit. With the covers removed from the tuning capacitor and T1, refer to Figure 11 and unsolder the blue, white-black, red-white, red-green, yellow-black and blue-red leads that come from the tube platform at the top of T1. Unsolder the leads from the tuning capacitor rotors, stators and ground straps at each section. Unsolder the lead from the tube platform at S3. Turn the Band Change control one-half turn from any band position in order to have the band switch contacts disengaged and leave the band switch in this position until the RF tube platform is replaced, otherwise irreparable damage to the switch contacts will occur. Remove the four screws at the corners of the top of the platform and the four screws at the side flange and carefully remove the platform. In handling be careful to prevent damage to the switch contacts of this assembly. When the unit is ready to be replaced, follow the reverse of the above procedure.

Main Tuning Capacitor - If it is necessary to replace the main tuning capacitor, the procedure is as follows: Remove the top cover and unsolder the leads of the capacitor as described under RF tube Platform. Bring the capacitor to full mesh by means of the tuning control. Carefully remove the spring and drive link at the front of the capacitor. Remove the single screw that secures the capacitor frame front plate to the gear plate, looping a piece of small wire around the spacing washer between the capacitor and gear plate. The front capacitor plate is located and held in position by two dowel pins and will not move when the front screw is taken out. Now hold the capacitor by its frame with one hand and remove the rear supporting screw and spacer. The capacitor may now be moved to the rear, to disengage the dowel pins, and lifted from the receiver. Follow the above procedure in reverse when replacing the capacitor.

## SECTION VI

## ALIGNMENT

The alignment of a modern communications receiver requires precision instruments and a thorough knowledge of the circuits involved. Since this receiver is a double super-heterodyne type, the alignment procedure is even more involved than usual.

Under normal service the receiver will stay in alignment for extremely long periods of time, consequently realignment should not be attempted unless all other possible causes of a particular trouble have been eliminated. When it has been determined that any realignment should be made, a great deal of caution should be exercised in making the adjustments, since any required readjustment should not entail more than a slight angular motion of the adjusting screw.

### ALIGNMENT OF THE IF STAGES

The low frequency IF should be aligned first. The recommended method for aligning the low frequency IF involves the use of a sweep frequency signal generator and an oscilloscope. Since these instruments are not available at the average service station the alternate method using an amplitude modulated signal generator and an output meter will be described first. The additional information required for the visual alignment method will be covered in a later paragraph.

The signal generator should be coupled to the grid of the mixer tube V5 through a capacitance of approximately .01 mfd. A miniature tube adapter will be required to make the mixer grid connection available. A suitable adapter, A/N No. CV-49519, is available as Part No. 977 from Alden Manufacturing Co., 117 N. Main Street, Brockton, Mass. An output meter should be connected across the output of the receiver or the speaker voice coil. The receiver controls should now be set as follows:

| Control | Position |
|---|---|
| Selectivity | See text |
| Send--Receive | Receive |
| CW--Mod | Mod |
| Phasing | Arrow |
| AVC--MAN | Man |
| Audio Gain | Set for approx. 20 volts output |
| RF Gain | See text |
| Band Switch | 1.35--3.45 mc |
| Dial | 2.5 mc |
| BFO-AVC | Int. Bfo fast |
| IFO | Int. |

The signal generator should be modulated 30 percent at 400 cycles. Turn the selectivity switch to the 3 kc position and advance the RF Gain control to maximum. Set the signal generator frequency to 455 kc and adjust its output until some deflection is noted on the output meter. Refer to figure 3 for the location of the various alignment adjustments. Adjust L42, L41, L39, L38, L36, and L32 for maximum output, reducing the signal generator output and the RF Gain control as required to prevent overload or excessive output. Now turn the selectivity switch to the narrowest position, .2 kc, and adjust the signal generator frequency for the maximum output. This establishes the correct signal frequency by the 455 kc crystal for the IF amplifier and the frequency of the signal generator should not be disturbed for

the remainder of the low frequency i.f. alignment, unless it should be to re-check this establishment of crystal frequency to make sure that the signal generator frequency has not drifted during the alignment. The selectivity switch is now turned to the 3 kc position and L42, L41, L39, L38, L36 and L32 are again adjusted for maximum output. Before changing this set-up the BFO should be turned on by throwing the CW-Mod switch to CW and checked for zero beat with the BFO knob dial at its zero reading. If necessary L44 should be adjusted for zero output. This check and adjustment of the BFO should be done with the signal generator carrier unmodulated.

The Procedure for the visual method of aligning the low frequency IF, using th double image system, should be the same as the above except that the adjustments a made for both maximum amplitude and coincidence of the oscilloscope images. The oscilloscope vertical input should be connected across the diode detector load resistance, from the junction of R64 and R65 to chassis.

The high frequency IF should be aligned next. Set the band switch to the 7.4--14.8 mc band. The selectivity switch should be in the 3 kc position. Adjust the signal generator frequency to 3.955 mc and adjust L31, L33, and L34 for maximu output.

The 3.5 mc crystal used in the second conversion oscillator circuit is held to a very close frequency tolerance and may be used as a frequency standard at multip of 3.5 mc from 10.5 mc upwards. In order to do this, in view of the complete shielding against radiation from this oscillator, it will be necessary to temporar ily connect a two foot length of insulated wire to the antenna terminal and dress the free end of this lead around the tube shield on the 3.5 mc oscillator tube V8. This test should, of course, be removed except while in use as a frequency standar

## ALIGNMENT OF THE RF AMPLIFIER & HF OSCILLATOR

To adequately align the RF Amplifier and HF Oscillator an accurately calibrate signal generator and an output meter are required. The frequencies required are shown in table 3. The location of the adjustments is shown in Figure 3. The use of Table 3 and Figure 3 should be made in following this part of the alignment whi will now be described for one frequency band. The same procedure should then be followed for the other frequency bands.

To align the .54-1.35 mc band the signal generator is coupled to the antenna input terminal through a 100-ohm carbon resistor. The generator should be modulate 30 percent at 400 cycles and the output meter connected across the receiver output terminals. The receiver controls should be set as follows:

| Control | Position |
|---|---|
| Selectivity | 3 kc |
| Send-Receive | Receive |
| CW-Mod | Mod |
| AVC-Man | See Text |
| Audio Gain | Set for approx. 20 volts output |
| RF Gain | See text |
| Band Switch | Set for band to be aligned |
| Limiter | Off |
| HFO | Var |

Set the receiver and signal generator dials to .56 mc. The RF Gain control should be set at maximum and the AVC-MAN switch set on AVC. The HF Osc. L adjustment shown in Figure 3, should now be set for maximum output. Then the Ant., 1st RF and 2nd RF L adjustments should be set for maximum output. The receiver and signal generator dials are now set to 1.3 mc and the C adjustments, shown in Figure 3, should be adjusted for maximum output in the same order, beginning with the Osc C adjustment and then making the C adjustments for the Ant, 1st RF and 2nd RF. This procedure should be carefully repeated until no increase in output can be realized. The AVC-MAN switch should then be set to MAN and the signal generator should be set for approximately 3 micro volts. The L and C adjustments should now be checked for maximum output, adjusting the RF Gain control as found necessary to maintain the output at approximately 20 volts.

Following the frequencies, shown in Table 3, align the remaining bands using the same procedure as above.

## TUBE SOCKET VOLTAGES-TABLE 1

Voltage to chassis. Measurements made with Weston Model 663 Volt-Ohmmeter, except those indicated by asterisk were made with Measurements Corp. Model 62 VTVM. The 500 volt scale was used for all voltages above 10 volts and the 10 volt scale for voltages below 10 volts. Line voltage 117, no signal input. Audio Gain control at minimum and CW-MOD switch on "CW".

| TUBE | SOCKET Pin Numbers | | | | | | | | | Mode of Operation |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | |
| V1 | -1 | - | 6.3ac | - | 200 | 95 | - | - | - | r-f gain max |
| V1 | -41 | - | 6.3ac | - | 260 | 245 | - | - | - | r-f gain min |
| V2 | -1 | - | 6.3ac | - | 210 | 95 | - | - | - | r-f gain max |
| V2 | -41 | - | 6.3ac | - | 260 | 245 | - | - | - | r-f gain min |
| V3 | 0 | - | - | 6.3ac | 285 | 0 | - | - | - | r-f gain max, var freq osc operation |
| V3 | 12.5 | - | - | 6.3ac | 285 | 140 | - | - | - | r-f gain max, crystal freq control |
| V3 | 0 | - | - | 6.3ac | 305 | 0 | - | - | - | r-f gain min, var freq osc operation |
| V3 | -12.5 | - | - | 6.3ac | 300 | 140 | - | - | - | r-f gain min, crystal freq control |
| V3 | 0 | - | - | 6.3ac | 285 | 0 | - | - | | r-f gain max, external operation |
| V4 | 130 | - | 6.3ac | - | 130 | - | - | - | - | r-f gain max or min. |
| V5 | - | 1.2 | 6.3ac | - | 140 | 110 | - | - | - | r-f gain max or min |
| V6 | - | - | 6-3ac | - | 225 | - | -1 | - | - | r-f gain max, freq below 7.4 mc |
| V6 | - | - | 6.3ac | - | 260 | - | -55 | - | - | r-f gain min, freq below 7.4 mc |
| V6 | - | - | 6.3ac | - | 225 | 80 | -1 | - | - | r-f gain max, freq above 7.4 mc |
| V6 | - | - | 6.3ac | - | 260 | 75 | -55 | - | - | r-f gain min, freq above 7.4 mc |
| V7 | -1 | - | 6.3ac | - | 215 | 125 | 3.4 | - | - | r-f gain max, freq below 7.4 mc |
| V7 | -54 | - | 6.3ac | - | 265 | 245 | .4 | - | - | r-f gain min, freq below 7.4 mc |
| V7 | -1 | - | 6.3ac | - | 215 | 0 | 0 | - | - | r-f gain max, freq above 7.4 mc |

| TUBE | SOCKET Pin Numbers 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Mode of Operation |
|---|---|---|---|---|---|---|---|---|---|---|
| V7 | -54 | - | 6.3ac | - | 265 | 0 | 0 | - | - | r-f gain min, freq above 7.4 mc |
| V8 | 0 | - | 6.3ac | - | - | - | - | - | - | freq below 7.4 mc, i-f-o switch at internal. |
| V8 | 75 | - | 6.3ac | - | 75 | -17 | - | - | - | freq above 7.4 mc, i-f-o switch at internal |
| V9 | -1 | - | 6.3ac | - | 205 | 90 | - | - | - | r-f gain max |
| V9 | -54 | - | 6.3ac | - | 260 | 150 | - | - | - | r-f gain min |
| V10 | -1.25 | -10 | 6.3ac | - | 200 | 92 | - | - | - | r-f gain max |
| V10 | -54 | -10 | 6.3ac | - | 240 | 140 | - | - | - | r-f gain min |
| V11 | -7.8 | - | 6.3ac | - | 210 | 140 | - | - | - | r-f gain max |
| V11 | -7.8 | - | 6.3ac | - | 235 | 140 | - | - | - | r-f gain min |
| V12 | 0 | - | 6.3ac | - | 192 | 72 | .9 | - | - | r-f gain max |
| V12 | 0 | - | 6.3ac | - | 215 | 80 | 1 | - | - | r-f gain min |
| V13 | 20 | - | 6.3ac | - | 20 | -3.3 | - | - | - | r-f gain max or min |
| V14 | - | - | 6.3ac | - | 22 | - | - | - | - | r-f gain max or min |
| V15 | - | - | 6.3ac | - | - | - | - | - | - | r-f gain max or min |
| V16 | 50 | - | 1.5 | - | - | 210 | - | 6.4 | 6.3ac | r-f gain max |
| V16 | 57 | - | 1.6 | - | - | 240 | - | 7.4 | 6.3ac | r-f gain min |
| V17 | - | - | 260 | 228 | - | - | 6.3ac | 12 | - | r-f gain max |
| V17 | - | - | 280 | 265 | - | - | 6.3ac | 13 | - | r-f gain min |
| V18 | 150 | - | - | - | 150 | - | - | - | - | r-f gain max or min |
| V19 | - | 300 | - | - | - | - | - | 300 | - | r-f gain max, 5.0 ac pin 2 to pin 8 |
| V19 | - | 320 | - | - | - | - | - | 320 | - | r-f gain min, 5.0 ac pin 2 to pin 8 |
| V20 | - | -96 | 6.3ac | - | - | - | -96 | - | - | r-f gain max |
| V20 | - | -97 | 6.3ac | - | - | - | -97 | - | - | r-f gain min |

## TUBE SOCKET TERMINAL RESISTANCE-TABLE 2

Resistance to chassis. Measurements made with Weston Model 663 Volt-Ohmmeter.

Tube removed from socket under measurement. Audio Gain Control at maximum, RF Gain Control at minimum. Limiter Switch "OFF". CW-MOD Switch on "CW". AVC-MAN Switch on "AVC".

| Tube | Socket Pin Numbers | | | | | | | | | Mode of Operation |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | |
| V1 | 1800K | 0 | - | 0 | 16.7K | 50K | 0 | - | - | |
| V2 | 1800K | 0 | - | 0 | 16.7K | 50K | 0 | - | - | |
| V3 | 23K | 0 | - | - | 15K | 17K | 0 | - | - | Crystal freq control positions 1-6. |
| V3 | 0 | 0 | - | - | 15K | infinity | 0 | - | - | Var freq or external |
| V4 | infinity | infinity | - | 0 | infinity | 47K | 0 | - | - | crystal freq control positions 1-6. |
| V4 | 19K | infinity | - | 0 | infinity | 47K | 0 | - | - | var freq osc operation |
| V5 | 47K | 150 | - | 0 | 19K | 22K | 26K | - | - | |
| V6 | 22K | 0 | - | 0 | 17.4K | infinity | 1100K | - | - | freq bands below 7.4 mc |
| V6 | 22K | 0 | - | 0 | 17.4K | 37.4K | 1100K | - | - | freq bands above 7.4 mc |
| V7 | 980K | 0 | - | 0 | 17.4K | infinity | 390 | - | - | freq bands above 7.4 mc |
| V7 | 980K | 0 | - | 0 | 17.4K | 48K | 390 | - | - | freq bands below 7.4 mc |
| V8 | infinity | infinity | 2 | 0 | 62 K | 9.5K | 0 | - | - | freq bands above 7.4 mc, i-f-o switch at internal |
| V8 | infinity | infinity | 2 | 0 | infinity | 9.5K | 0 | - | - | freq bands above 7.4 mc, i-f-o switch at external |
| V9 | 1100K | 0 | - | 0 | 17.5K | 9.5K | 0 | - | - | |
| V10 | 1100K | 117K | - | - | 17K | 9.5K | 0 | - | - | - |
| V11 | 93K | 0 | - | 0 | 17.5K | 19K | 0 | - | - | |
| V12 | 1.2 | 0 | - | - | 17K | 61K | 100 | - | - | |
| V13 | - | - | - | - | 160K | 100K | 0 | - | - | |
| V14 | 0 | 816K | - | 0 | 15.6K | 0 | 196K | - | - | |
| V15 | 69K | infinity | - | 0 | infinity | 0 | 196K | - | - | |
| V16 | 125K | 500K | 1K | 0 | 0 | 17.4K | 470K | 680 | - | |
| V17 | 0 | 0 | 15.6K | 15.2K | 470K | infinity | - | 360 | - | |
| V18 | 118K | - | - | - | 20K | - | 0 | - | - | |
| V19 | - | 15.8K | 0 | 42 | - | 40 | - | 15.8K | - | |
| V20 | 49K | 65K | - | 0 | 49K | 0 | 65K | - | - | |

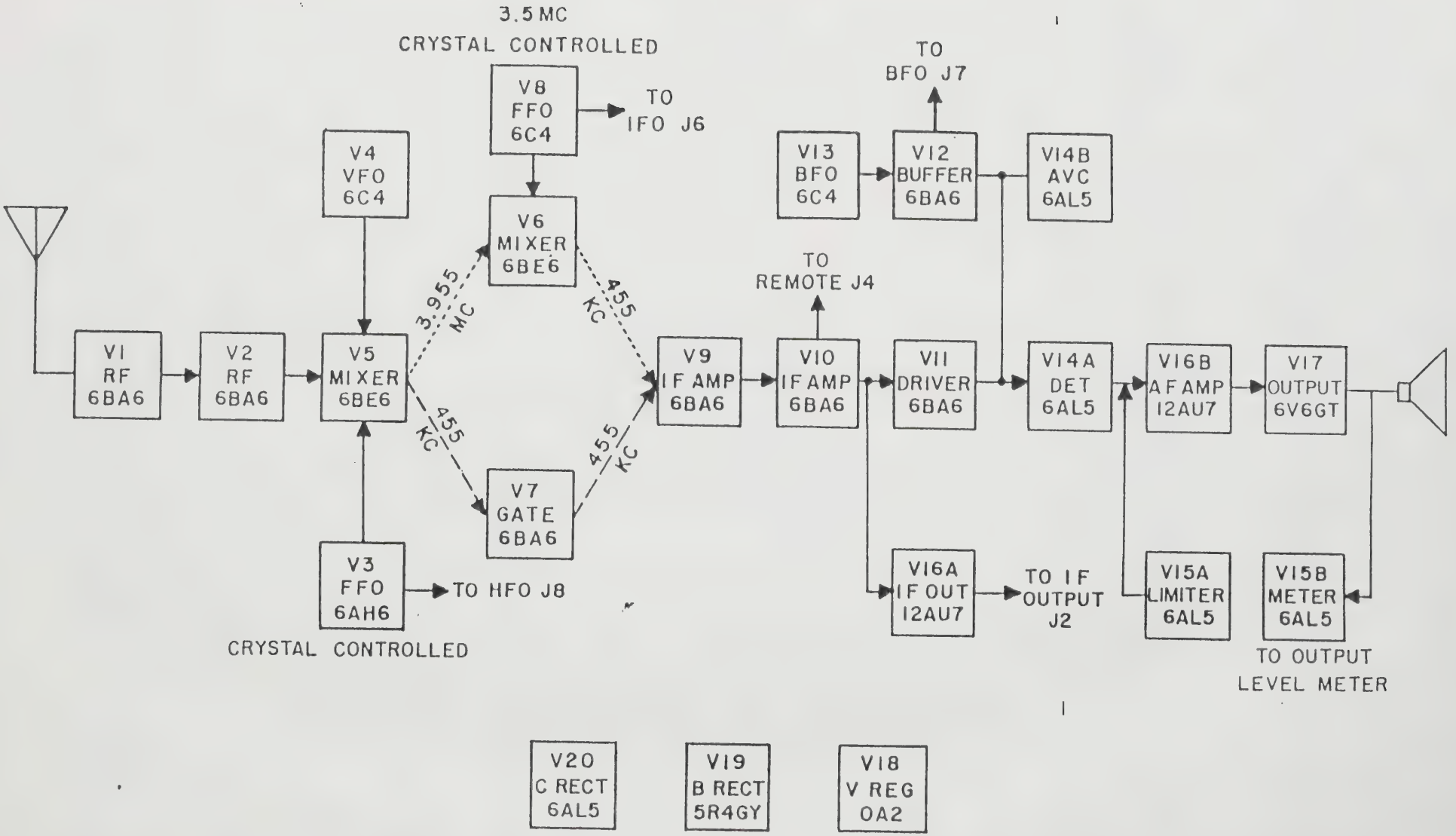
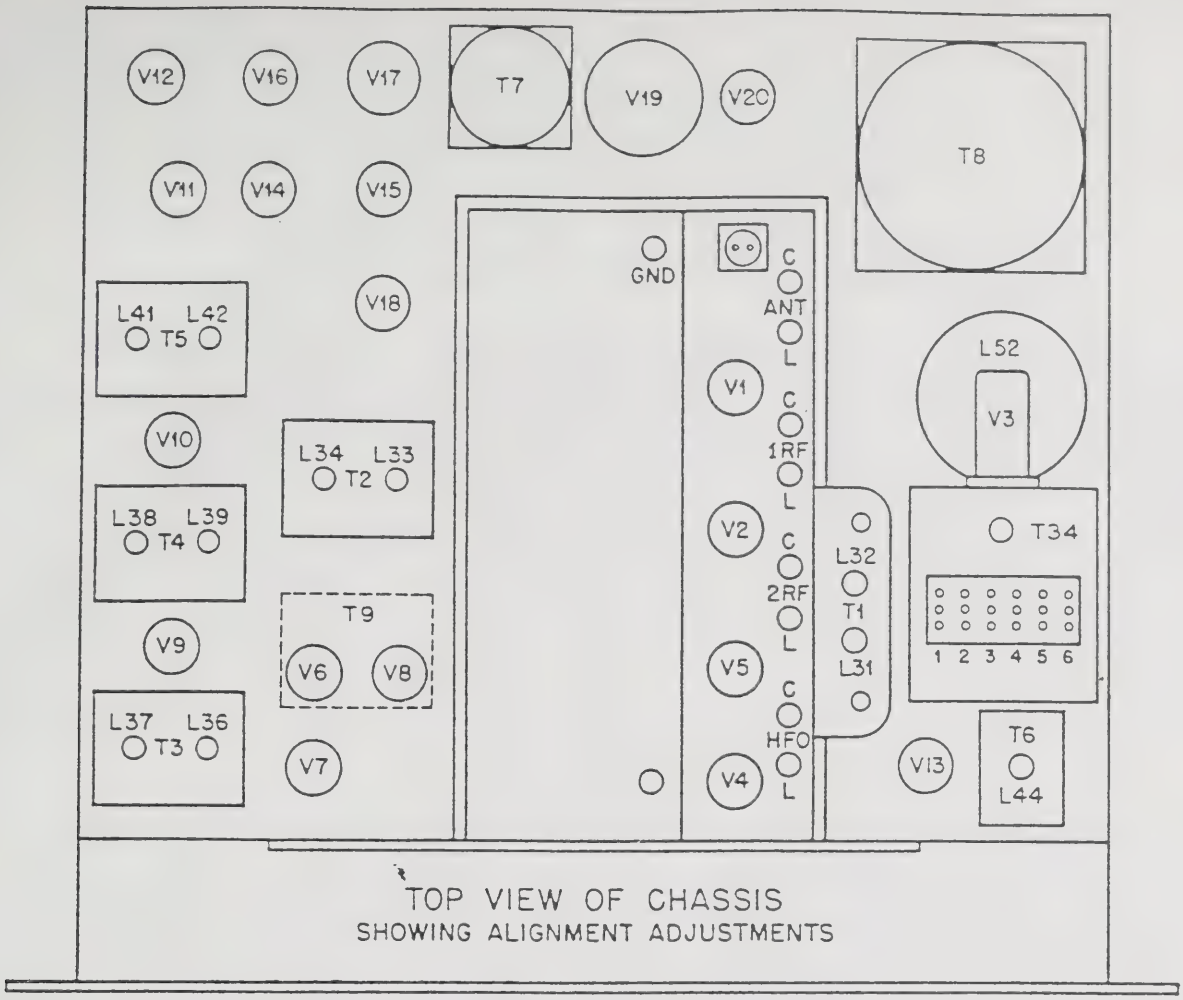



FIG. 2
BLOCK DIAGRAM




TOP VIEW OF CHASSIS
SHOWING ALIGNMENT ADJUSTMENTS

FIG. 3

## •AUDIO AND OVERALL FIDELITY CURVES•

SOLID CURVE is the fidelity of the audio frequency amplifier with input applied between terminal 3 of R84 (Figure 10) and ground, and with the r-f gain control at min.

DOTTED CURVE is the overall fidelity at 2.5 mc; AM of 30 percent, selectivity switch in 13 kc position, and r-f gain control set for 10 mw reference level output.

In each instance, the output is measured across a 600-ohm resistive load and audio gain control set at max.

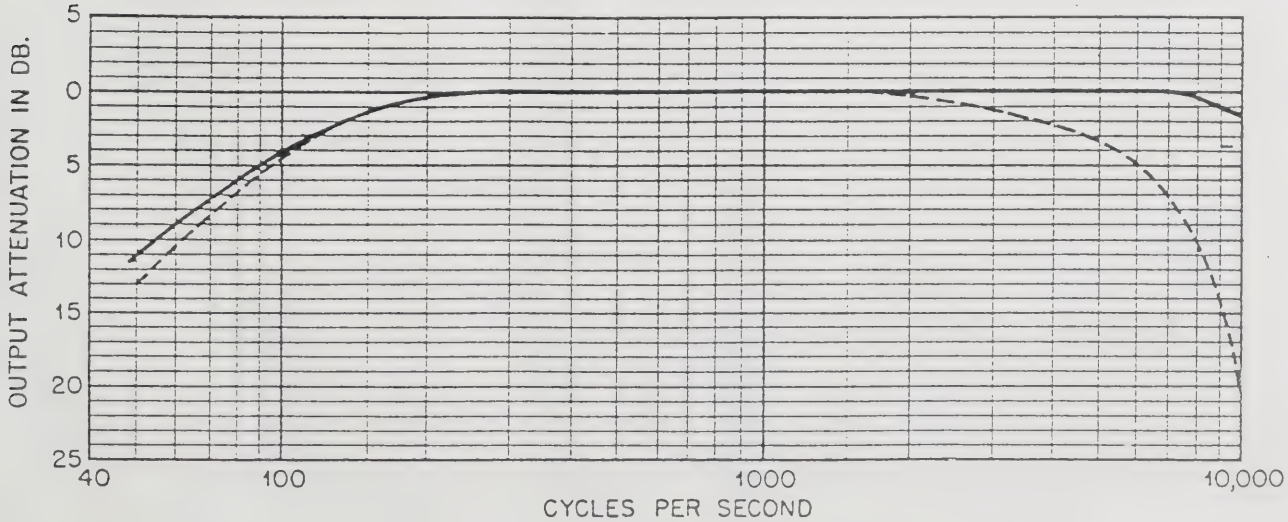



FIG. 4

# TABLE No. 3

RF AND HF OSCILLATOR ALIGNMENT FREQUENCIES AND ADJUSTMENT DESIGNATIONS

| FREQ. BAND IN MC | .54—1.35 | 1.35—3.45 | 3.45—7.4 | 7.4—14.8 | 14.8—29.7 | 29.7—54.0 |
|---|---|---|---|---|---|---|
| RF & HF OSC ADJUST L AT. | .56 | 1.4 | 3.75 | 7.5 | 15.0 | 30.0 |
| RF & HF OSC ADJUST C AT. | 1.3 | 3.4 | 7.15 | 14.5 | 29.0 | 52.0 |

# TABLE No. 4

APPROXIMATE SIGNAL INPUT AT IF & AF STAGES FOR 20 VOLTS OUTPUT

Output measured across a 600 ohm resistive load at output terminals of receiver. RF signals modulated 30 percent at 400 cycles. Signals applied to tube grids through a .01 mfd capacitor. Selectivity switch at 3 kc AVC — MAN switch on MAN. CW — MOD switch on MOD, RF Gain and Audio Gain at maximum.

| BAND SWITCH | FREQUENCY | INPUT TO | APPROX. INPUT |
|---|---|---|---|
| Any | Audio 400 cycles | Pin 5, V17 | 5.5 volts |
| Any | Audio 400 cycles | Pin 2, V16B | .5 volts |
| 1.35—3.45 mc | Mod RF 455 kc | Pin 1, V11 | .6 volts |
| 1.35—3.45 mc | Mod RF 455 kc | Pin 1, V10 | 15000 microvolts |
| 1.35—3.45 mc | Mod RF 455 kc | Pin 1, V9 | 300 microvolts |
| 1.35—3.45 mc | Mod RF 455 kc | Pin 1, V7 | 75 microvolts |
| 1.35—3.45 mc | Mod RF 455 kc | Pin 7, V5 | 90 microvolts |
| 7.40—14.8 mc | Mod RF 3.955 mc | Pin 7, V5 | 70 microvolts |
| 7.40—14.8 mc | Mod RF 3.955 mc | Pin 7, V6 | 100 microvolts |

## • SELECTIVITY CURVES
### Overall at 2 Megacycles •

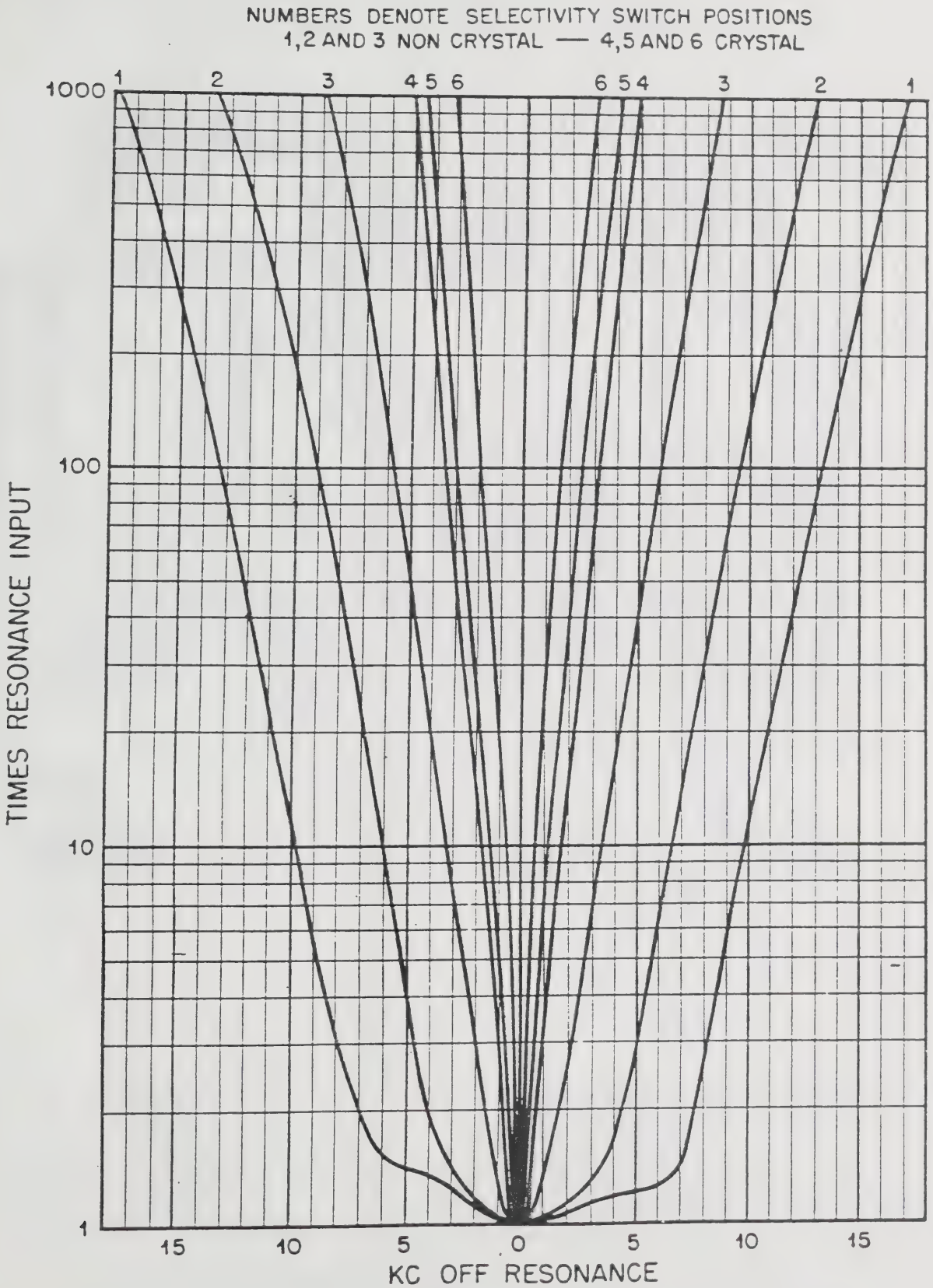
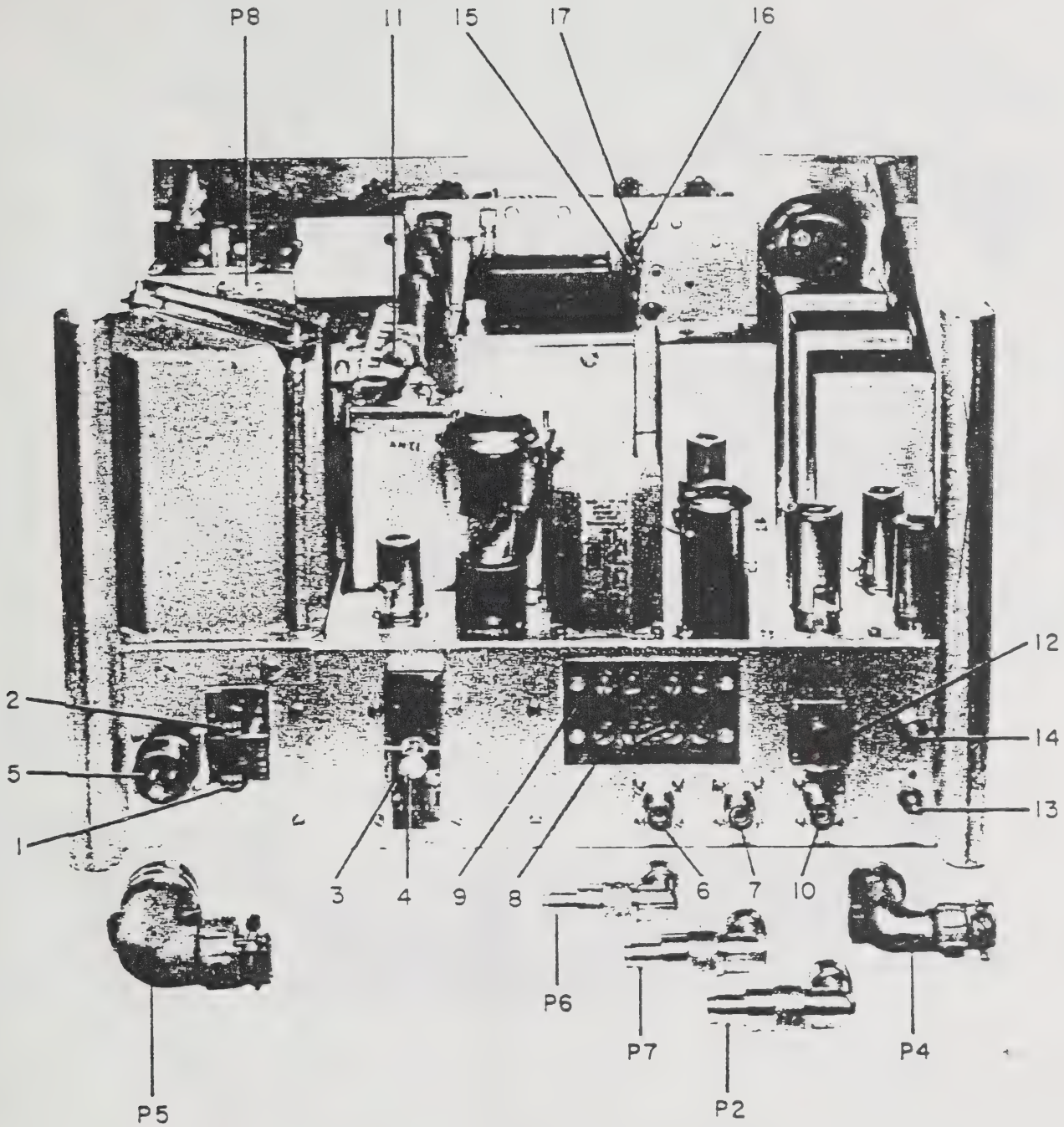

NUMBERS DENOTE SELECTIVITY SWITCH POSITIONS
1,2 AND 3 NON CRYSTAL — 4,5 AND 6 CRYSTAL
1000
100
10
1
TIMES RESONANCE INPUT
1 2 3 4 5 6 6 5 4 3 2 1
15 10 5 0 5 10 15
KC OFF RESONANCE

FIG. 5




1. "1.6A SLO FUSE" holder
2. "⅜A FUSE holder
3. "SPARE FUSES" cover
4. Captive screw
5. "AC POWER" connector
6. "IFO" connector
7. "BFO" connector
8. "AUDIO OUTPUT" terminals
9. "DIODE OUTPUT" "AVC" terminals
10. "IF OUTPUT" connector
11. "ANT" input connector
12. "REMOTE" connector
13. "METER ADJ RF" control
14. "METER ADJ AF" control
15. Allen wrench, No. 6
16. Allen wrench, No. 8
17. Allen wrench, No. 10

P2, P4, P6 & P7 Optionally supplied to non-service users.

*Figure 6. Radio Receiver, Rear View of Chassis*

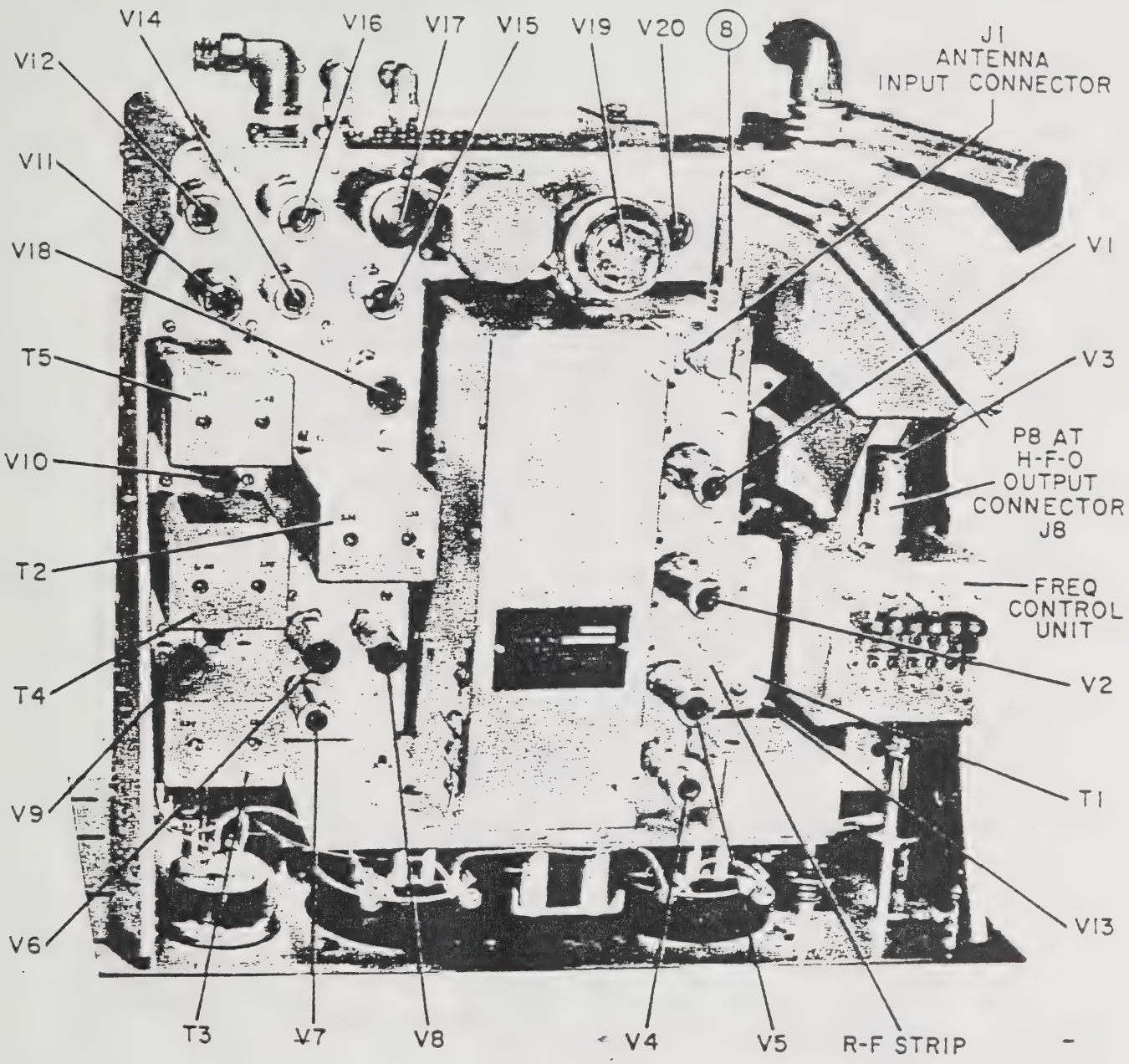



*Figure 7. Radio Receiver, Top View of Chassis*

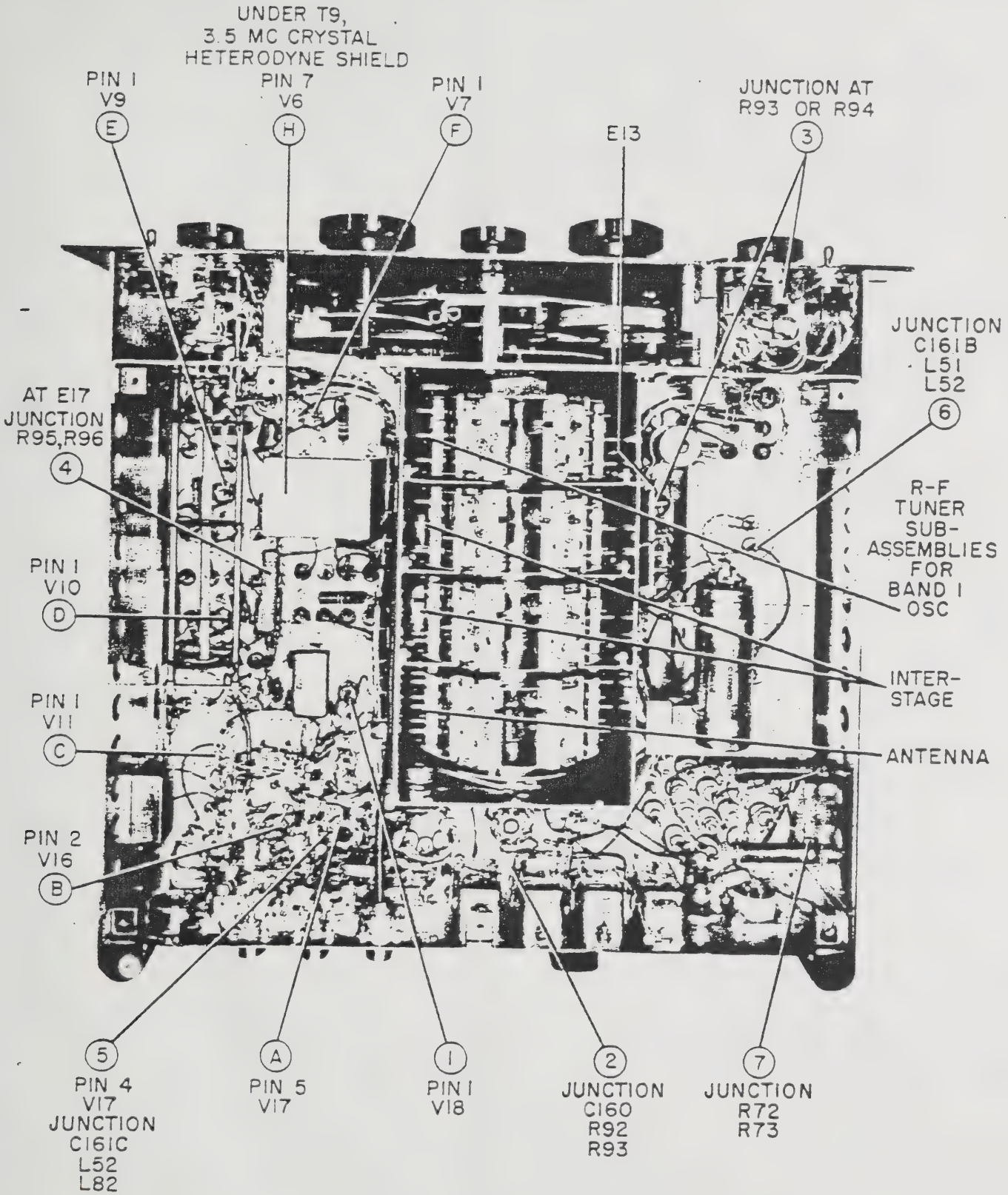
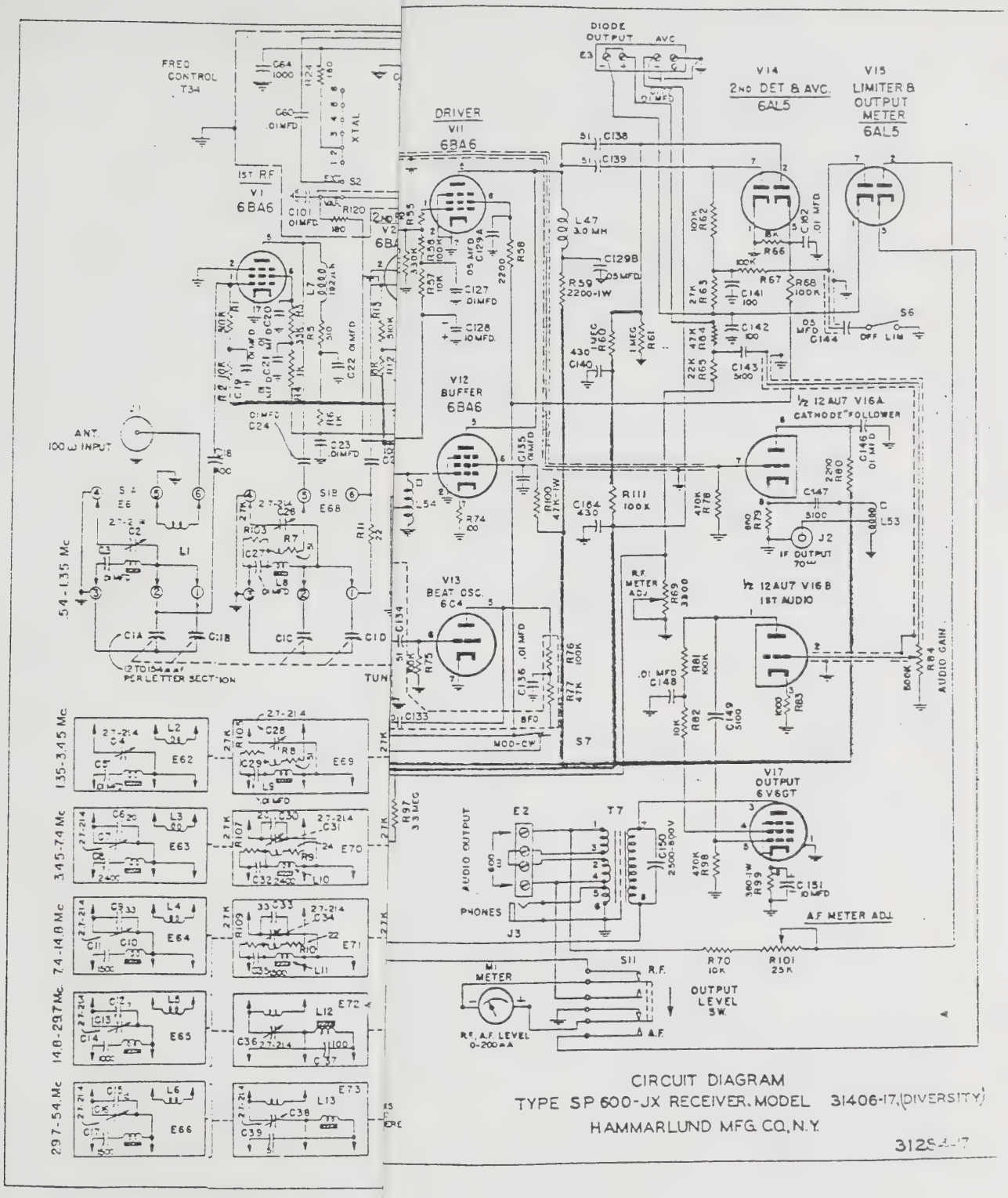



*Figure 8. Radio Receiver, Parts Identification for Locating Test Points*




CIRCUIT DIAGRAM
TYPE SP 600-JX RECEIVER, MODEL 31406-17, (DIVERSITY)
HAMMARLUND MFG. CO., N.Y.

3129-17



CIRC

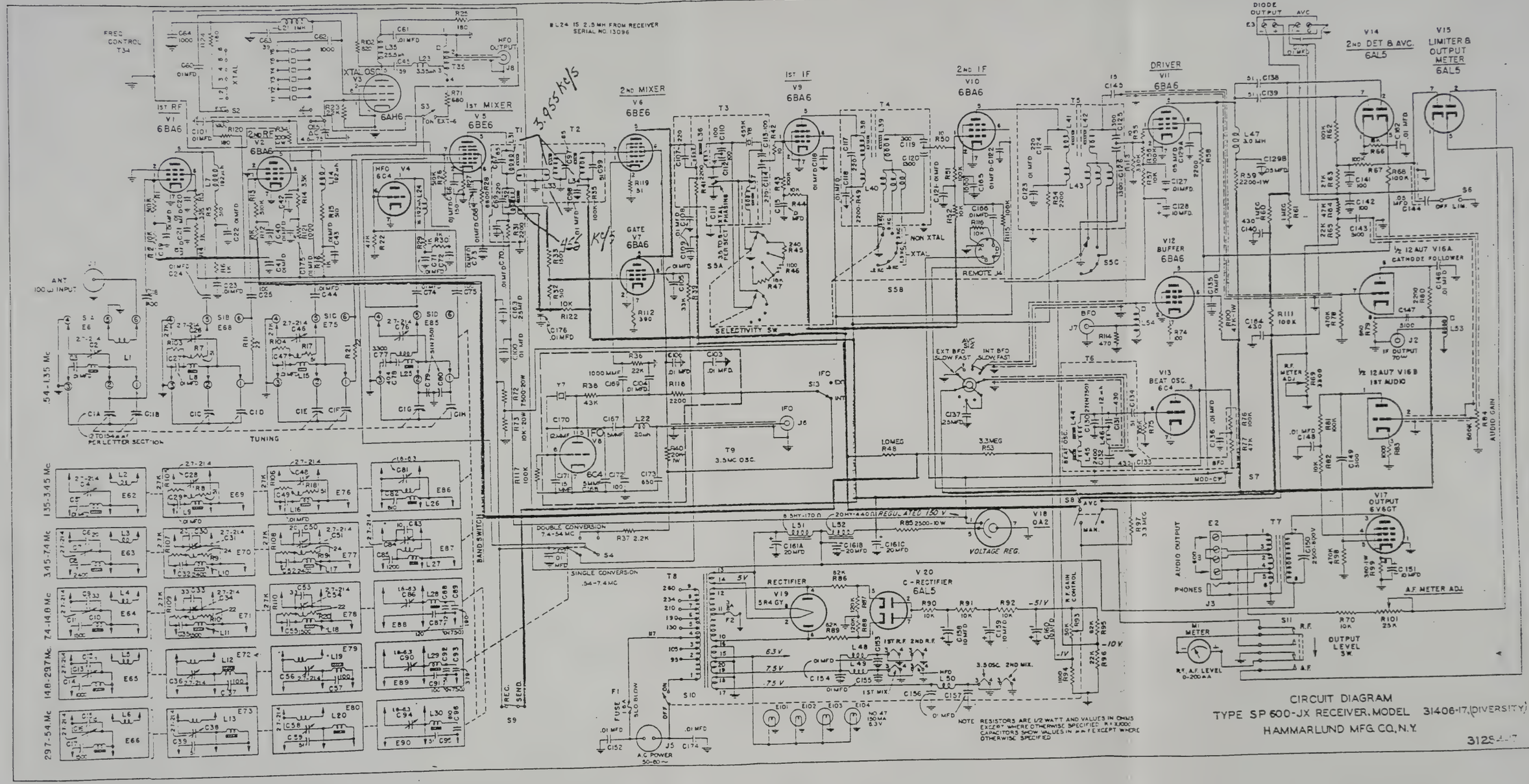
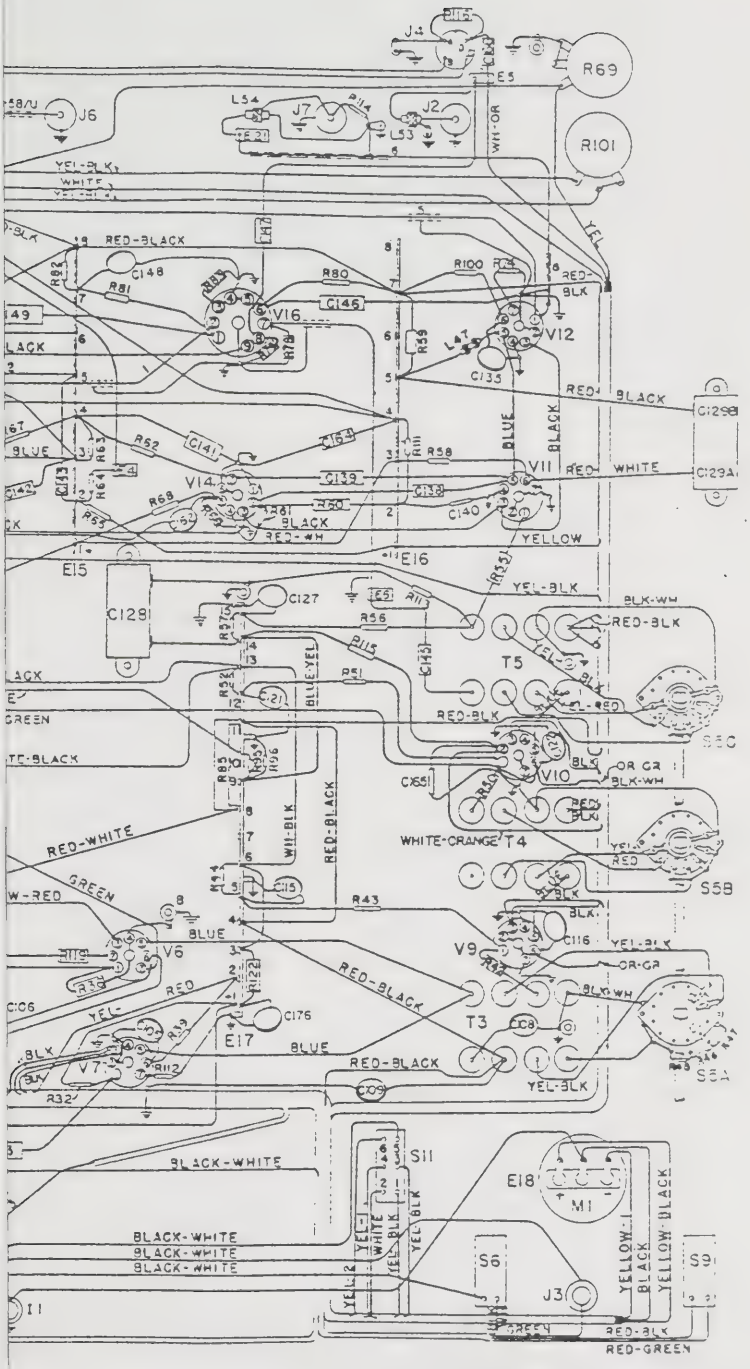

CIRCUIT DIAGRAM
TYPE SP 600-JX RECEIVER, MODEL 31406-17, (DIVERSITY)
HAMMARLUND MFG. CO., N.Y.
3125A-17
TUNING
54-135 Mc
135-345 Mc
345-74 Mc
74-14.6 Mc
14.8-29.7 Mc
29.7-54 Mc
SINGLE CONVERSION .54-7.4 MC
DOUBLE CONVERSION 7.4-54 MC
NOTE RESISTORS ARE 1/2 WATT AND VALUES IN OHMS EXCEPT WHERE OTHERWISE SPECIFIED. K=1000; CAPACITORS SHOW VALUES IN MMF EXCEPT WHERE OTHERWISE SPECIFIED

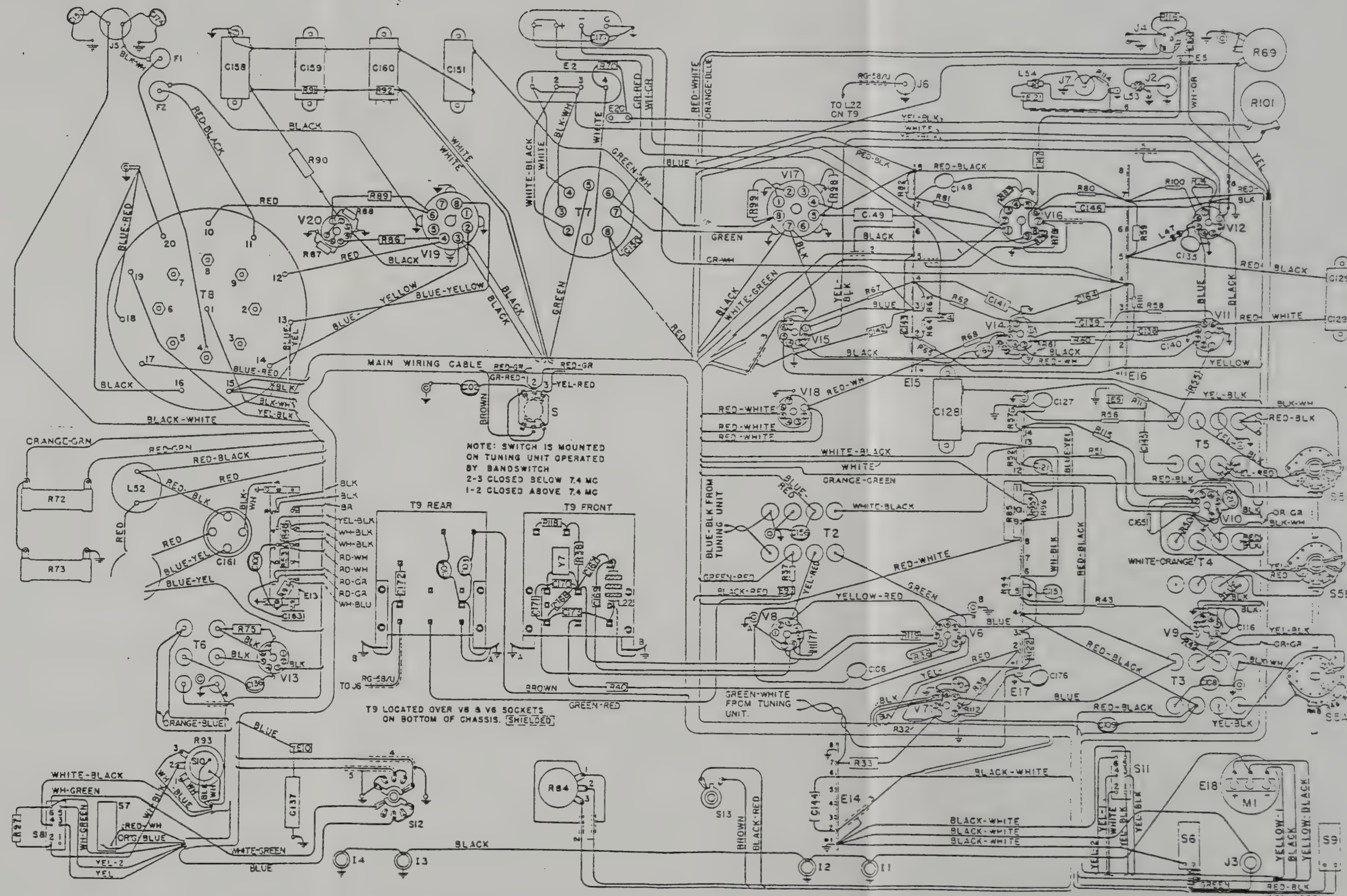
FIG. 9
CIRCUIT DIAGRAM OF RECEIVER




* THESE NUMBERS ARE FOR REFERENCE ONLY. THEY DO NOT APPEAR ON TERMINAL STRIP

*FIG. 10*

CONNECTION DIAGRAM - RECEIVER CHASSIS




NOTE THE COLOR ENCODED ELECTRICAL WIRE IS AS PER JAN-C-76, AMENDMENT 4, OF TYPE AND SIZE CONFORMING TO WL-3/5(7)-22-C. THE BARE, SOLID SOFT DRAWN TINNED COPPER ELECTRICAL WIRE IS OF AWG SIZE NO. 22 (BBR NOS. 1425 OR 1426) THE SHIELDED INSULATED CABLE IS OF AWG SIZE NO. 24 AND HAS 16, NO. 36 STRANDS (ALPHA NO. 1248-PL) THE COAXIAL CABLE (RG-58/U) IS AS PER JAN-C-17.

* THESE NUMBERS ARE FOR REFERENCE ONLY. THEY DO NOT APPEAR ON TERMINAL STRIP

*FIG. 10*

CONNECTION DIAGRAM - RECEIVER CHASSIS

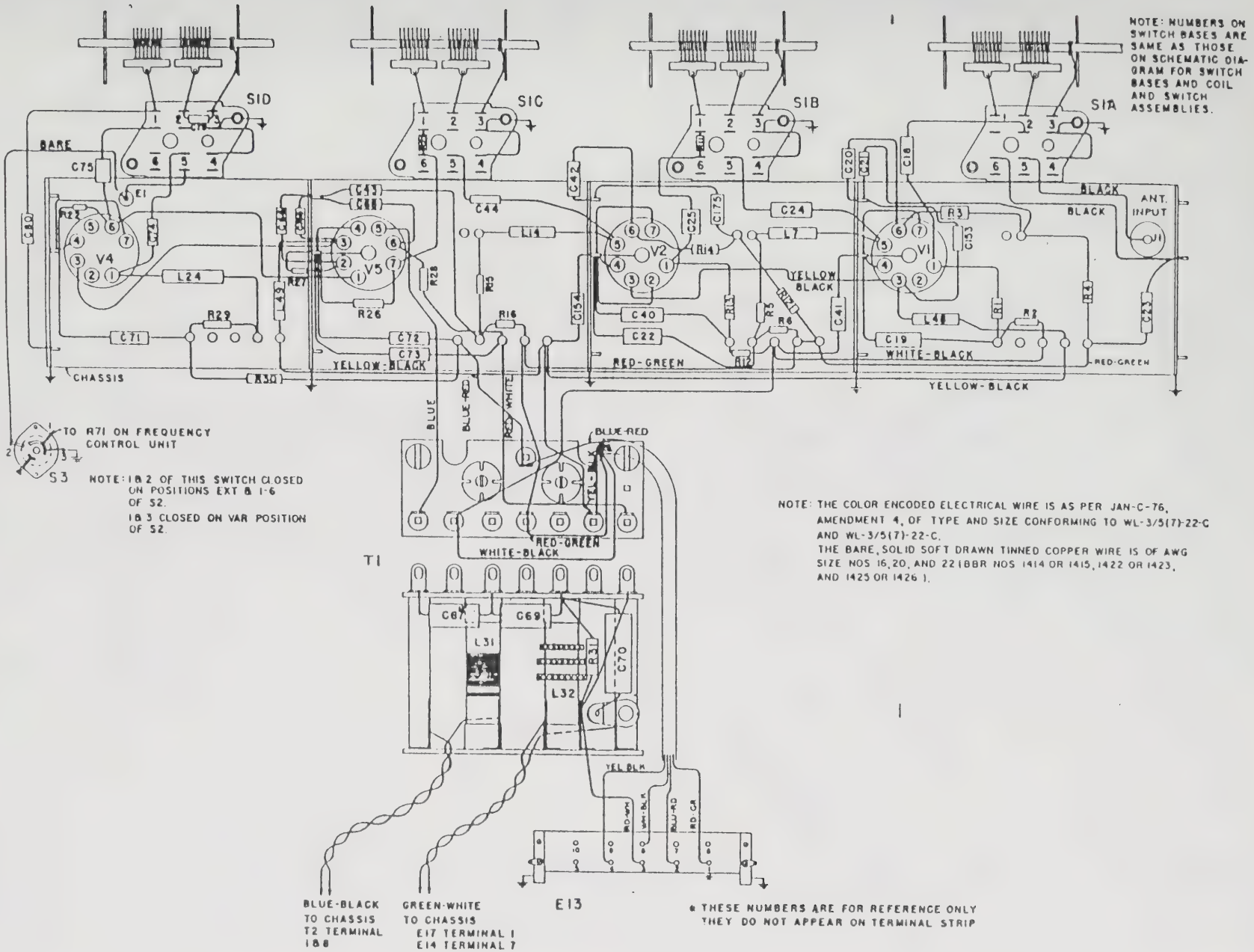
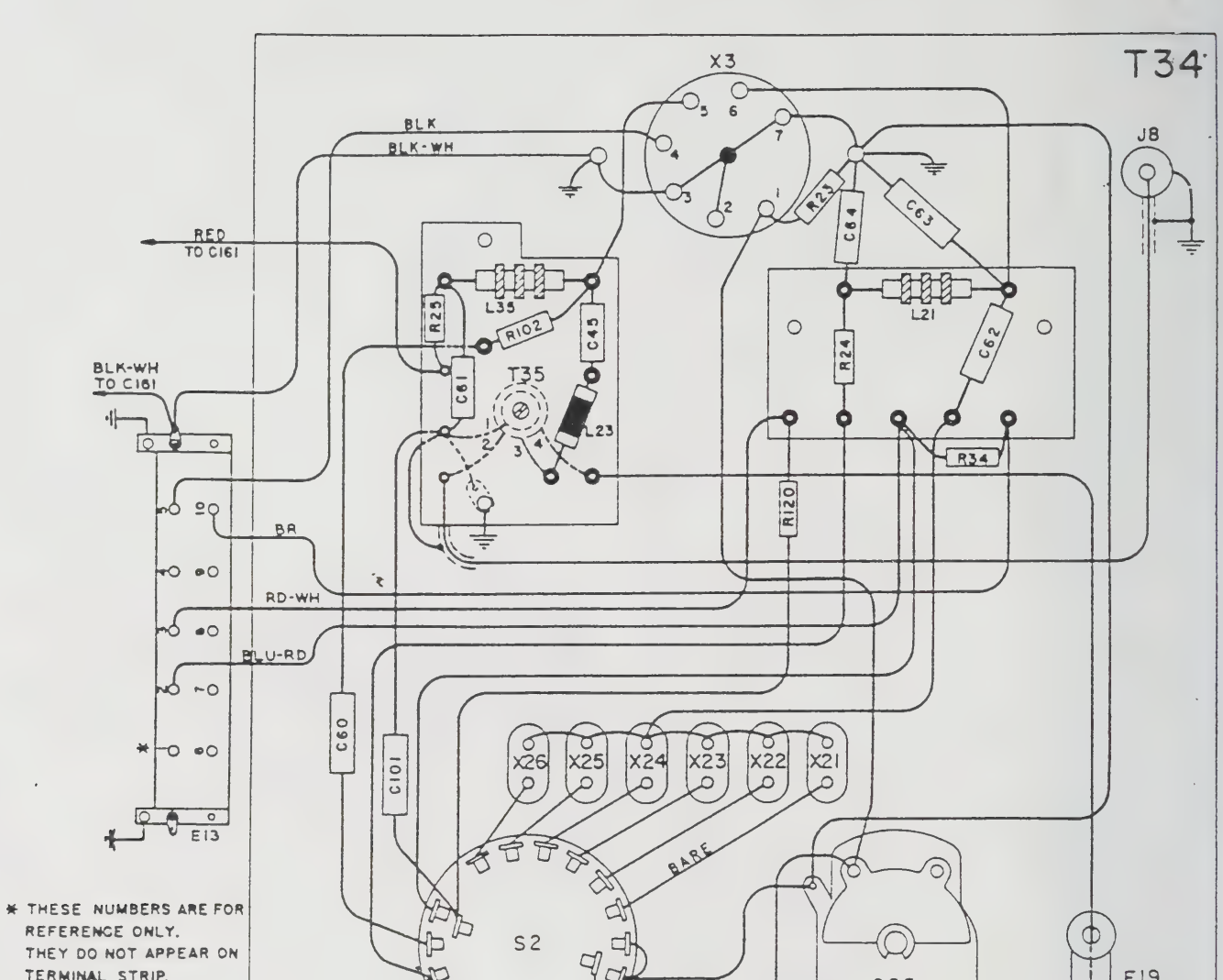



*Figure 11. Radio Receiver, Tuning Unit Connection Diagram*




NOTE:
THE COLOR ENCODED ELECTRICAL WIRE IS AS PER JAN-C-76, AMENDMENT 4, OF TYPE AND SIZE CONFORMING TO WL-3/5(7)-22-C.
THE BARE, SOLID SOFT DRAWN TINNED COPPER WIRE IS OF AWG SIZE NO. 20 (BBR NOS. 1422 OR 1423).
THE SHIELDED INSULATED CABLE IS OF AWG SIZE NO. 24 AND HAS 16, NO. 36 STRANDS (ALPHA NO. 1248-PL).

*Figure 12. Radio Receiver, Frequency Control Unit Connection Diagram*

REPLACEABLE PARTS LIST

| Symbol Designations | Description | Hammarlund Part No. |
|---|---|---|
| C1A to H | Capacitor, Variable, 8 sections | 34001-G1 |
| C3,C5,C19-C24 C27,C29,C40,C44 C47,C49,C60,C61 C66,C68,C70-C74 C101,C105,C115,C116 C121,C122,C127,C135 C153-C155,C166 C175,C176 | Capacitor, .01 mfd | 23034-19 |
| C6,C30,C50 | Capacitor, 20 mmf | 23003-41C |
| C8,C32,C52,C132 | " 2400 mmf | 23011-40C |
| C9,C33,C53 | " 33 mmf | 23003-45C |
| C11,C17,C35,C55 | " 1500 mmf | 23011-62C |
| C12 - | " 7 mmf | 23061-168F |
| C14,C62,C64,C165 C169 | " 1000 mmf | 23011-58C |
| C15,C145,C171 | " 15 mmf | 23061-155J |
| C18,C25,C37,C57 C75,C91,C110,C112 C113 | " 100 mmf | 23003-94C |
| C39,C59,C95 C99,C134 | " 51 mmf | 23003-87C |
| C45 | " 59 mmf | 23071-72 |
| C63 | " 39 mmf | 23003-47C |
| C65 | " Variable | 11726-G109 |
| C67 | " 85 mmf | 23071-59 |
| C69,C107,C117 C124 | Capacitor, 220 mmf | 23003-102C |
| C77 | " 3300 mmf | 23011-69C |
| C78 | " 404 mmf | 23071-67 |
| C79,C80,C167 C168 | " 5 mmf | 23023-8UJ |
| C82 | " 810 mmf | 23072-53 |
| C83 | " 10 mmf | 23003-2B |
| C85 | " 1200 mmf | 23011-60C |
| C87 | " 120 mmf | 23071-50 |
| C88,C170 | " 12 mmf | 23023-65UJ |
| C89 | " 190 mmf | 23071-64 |
| C92,C138,C139 | " 51 mmf | 23023-45UJ |
| C93 | " 379 mmf | 23071-63 |
| C96 | " 610 mmf | 23072-52 |
| C97 | " 65 mmf | 23071-58 |
| C98,C100,C102- C104,C106,C108 C109,C118,C123 C136,C146,C148 C156,C157,C162 | " .01 mfd | 23034-19 |
| C111 | " Variable | 11776-G1 |
| C114 | " 270 mmf | 23003-104C |
| C119,C125 | " 300 mmf | 23003-105C |
| C120,C126 | " 1300 mmf | 23011-61C |
| C128,C151,C158 C159-C160 | Capacitor, 10 mfd, 100V HS Can, Electrolytic | 15462-1 |
| C129A,B | Capacitor, 2x.05 mfd HS Can, Paper | 15461-1 |

| Symbol Designations | Description | Hammarlund Part No. |
|---|---|---|
| C130 | Capacitor, 27 mmf | 23023-71UJ |
| C131,C133 | " 430 mmf | 23003-109C |
| C137 | " .25 mfd, 200V | 23911-79E |
| C140,C164 | " 430 mmf | 23003-109C |
| C141,C142 | " 100 mmf | 23024-24SL |
| C143,C147,C149 | " 5100 mmf | 23015-16A |
| C144 | " .05 mfd | 23911-77E |
| C150 | " 2500 mmf, 800V | 23070-40 |
| C152,C174,C177 | " .01 mfd, 1400 V | 23034-26 |
| C161A,B,C | " 320 mfd, 450V, HS Can, Electrolytic | 15463-1 |
| C163 | Capacitor, .25 mfd, 600V | 23915-1 |
| C172 | " 100 mmf | 23003-94 |
| C173 | " 650 mmf | 23071-73 |
| E1 | Insulator, Bushing | 16619-5 |
| E2 | 4 Screw Terminal, Audio Output | 31141-1 |
| E3 | 4 Screw Terminal, Diode and AVC | 31480-1 |
| E4 | 1 Solder Terminal Strip (left) | 16650-9 |
| E5 | 2 Solder Terminal Strip | 16650-12 |
| E6-E10 | 1 Solder Terminal Strip (right) | 16650-11 |
| E11 | 9 Post Terminal Board | 33914-G1 |
| E12 | 7 Post Terminal Board | 33915-G1 |
| E13 | 10 Post Terminal Board | 33928-2 |
| E14 | 6 Solder Terminal Strip | 16650-10 |
| E15-E16 | 8 Solder Terminal Strip | 31163-G1 |
| E17 | 15 Solder Terminal Strip | 31162-G1 |
| E18 | 3 Solder Terminal Strip (meter) | 31454-G1 |
| E19 | Insulator, feed-thru | 31482-1 |
| E61 | RF Tuner, includes C2,C3,L1 and switch contacts for S1A | 31387-G1 |
| E62 | RF Tuner, includes C4,C5,L2 and switch contacts for S1A | 31390-G1 |
| E63 | RF Tuner, includes C6,C7,C8,L3 and switch contacts for S1A | 31393-G1 |
| E64 | RF Tuner, includes C9,C10,C11,L4 and switch contacts for S1A | 31396-G1 |
| E65 | RF Tuner, includes C12,C13,C14,L5 and switch contacts for S1A | 31399-G1 |
| E66 | RF Tuner, includes C15,C16,C17,L6 and switch contacts for S1A | 31405-G1 |
| E68 | RF Tuner, includes C26,C27,L8,R7,R103 and switch contacts for S1B | 31386-G1 |
| E69 | RF Tuner, includes C28,C29,L9,R8,R105 and switch contacts for S1B | 31389-G1 |
| E70 | RF Tuner, includes C30,C31,C32,L10, R9,R107, and switch contacts for S1B | 31392-G1 |
| E71 | RF Tuner, includes C33,C34,C35,L11, R10,R109, and switch contacts for S1B | 31395-G1 |
| E72 | RF Tuner, includes C36,C37,L12 and switch contacts for S1B | 31398-G1 |
| E73 | RF Tuner, includes C38,C39,L13 and switch contacts for S1B | 31404-G1 |
| E75 | RF Tuner, includes C46,C47,L15,R17, R104 and switch contacts for S1C | 31386-G1 |
| E76 | RF Tuner, includes C48,C49,L16,R18, R106 and switch contacts for S1C | 31389-G1 |

| Symbol Designations | Description | Hammarlund Part No. |
|---|---|---|
| E77 | RF Tuner, includes C50,C51,C52,L17,R19 R108 and switch contacts for S1C | 31392-G1 |
| E78 | RF Tuner, includes C53,C54,C55,L18,R20 R110 and switch contacts for S1C | 31395-G1 |
| E79 | RF Tuner, includes C56,C57,L19 and switch contacts for S1C | 31398-G1 |
| E80 | RF Tuner, includes C58,C59,L20 and switch contacts for S1C | 31404-G1 |
| E85 | RF Tuner, includes C76,C77,C78,L25 and switch contacts for S1D | 31385-G1 |
| E86 | RF Tuner, includes C81,C82,L26 and switch contacts for S1D | 31388-G1 |
| E87 | RF Tuner, includes C83,C84,C85,L27 and switch contacts for S1D | 31391-G1 |
| E88 | RF Tuner, includes C86,C87,C88,C89,L28 and switch contacts for S1D | 31394-G1 |
| E89 | RF Tuner, includes C90,C91,C92,C93 L29 and switch contacts for S1D | 31397-G1 |
| E90 | RF Tuner, includes C94,C95,C96,L30 and switch contacts for S1D | 31403-G1 |
| E101-E104 | Dial Lamp, No. 47 Mazda | 16004-1 |
| F1 | Fuse, 1.6A Fusetron | 15893-1 |
| F2 | Fuse, 3/8 Amp | 15928-13 |
| J1,J2,J6-J8 | Connector Socket,ANT,IF,IFO,BFO, and HFO | 16111-1 |
| J3 | Phone Jack | 5066-1 |
| J4 | Connector Socket, remote | 15991-4 |
| J5 | Connector Socket, power | 15966-2 |
| L7,L14,L35 | RF Choke, 192 Microhenrys | 15612-G1 |
| L21 | RF Choke, 1 millihenry | 15617-G1 |
| L22 | RF Choke, 20 Microhenrys | 15621-1 |
| L23 | RF Choke, 3.55 Microhenrys | 15623-1 |
| L24 | RF Choke, 2.5 Millihenrys | 15627-1 |
| L35 | RF Choke, 25.5 Microhenrys | 15622-1 |
| L46 | RF Choke, 12 Microhenrys | 15615-2 |
| L47 | RF Choke, 3.0 Millihenrys | 15616-G1 |
| L48 | RF Choke, 2 ohms DC | 15611-1 |
| L49,L50 | RF Choke, 2.7 ohms DC | 15613-1 |
| L51 | 1st Filter Choke, 8.5 Hy, 170 ohms DC | 31030-2 |
| L52 | 2nd Filter Choke, 20 Hy, 440 ohms DC | 31031-2 |
| L53,L54 | If Automtransformer, If output & BFO External | 31488-1 |
| M1 | Tuning meter | 4903-2 |
| P1,P2,P6-P8 | Connector plug, ANT,IF,IFO,BFO, and HFO | 16071-1 |
| | Connector (for P1,P2,P6,P7) | 16112-1 |
| | Adapter, reducer (for P1,P2,P6-P8) | 16642-1 |
| P4 | Connector plug, remote | 16188-1 |
| | Clamp, Cable (for P4) | 16120-3 |
| P5 | Connector Plug, power clamp | 16189-1 |
| | Cable (for P5) | 16120-5 |
| R1,R13,R26 | Resistor, 510K, 1/3 watt | 19317-76BF |

| Symbol Designations | Description | Hammarlund Part No. |
|---|---|---|
| R2,R12,R44,R52 R57,R70,R82 R90-R92,R116 R122 | Resistor, 10K, ½ watt | 19309-278BF |
| R3,R14,R39 | Resistor, 33K, ½ watt | 19309-282BF |
| R4,R6,R16,R29 R30,R83,R121 | Resistor, 1K, ½ watt | 19309-49BF |
| R5,R15,R32 | Resistor, 510 ohms, ½ watt | 19309-170BF |
| R7,R8,R17,R18 R119 | Resistor, 51 ohms, ½ watt | 19309-193BF |
| R9,R19 | Resistor, 24 ohms, ½ watt | 19309-189BF |
| R10,R11,R20,R21 | Resistor, 22 ohms, ½ watt | 19309-9BF |
| R22,R64,R65,R77 | Resistor, 47K, ½ watt | 19309-89BF |
| R23 | Resistor, 22K, ½ watt | 19309-178BF |
| R24,R25,R120 | Resistor, 180 ohms, ½ watt | 19309-31BF |
| R27 | Resistor, 150 ohms, ½ watt | 19309-31BF |
| R28 | Resistor, 6800 ohms, ½ watt | 19309-69BF |
| R31,R37,R41,R49 R54,R58,R80 R118 | Resistor, 2200 ohms, ½ watt | 19309-57BF |
| R33 | Resistor, 1500 ohms, ½ watt | 19309-53BF |
| R34 | Resistor, 100K, 1 watt | 19310-191 |
| R35,R43,R51 R56,R62,R67 R68,R75,R76,R81 R100,R115,R117 | Resistor, 100K, ½ watt | 19309-97BF |
| R36,R96 | Resistor, 22K, ½ watt | 19309-178BF |
| R38 | Resistor, 43K, ½ watt | 19309-222 |
| R40 | Resistor, 20K, 1 watt | 19310-179BF |
| R42,R50,R55 | Resistor, 10 ohms, ½ watt | 19309-1BF |
| R45 | Resistor, 240 ohms, ½ watt | 19309-201BF |
| R46,R94 | Resistor, 1100 ohms, ½ watt | 19309-208BF |
| R47,R66 | Resistor, 18K ½ watt | 19309-79BF |
| R48,R60,R61 | Resistor, 1 megohm, ½ watt | 19309-121BF |
| R53,R97 | Resistor, 3.3 megohms, ½ watt | 19309-133BF |
| R59 | Resistor, 2200 ohms, 1 watt | 19310-57BF |
| R63,R103,R110 | Resistor, 27K, ½ watt | 19309-83BF |
| R69 | Resistor, Variable, 3300 ohms | 15366-1 |
| R71,R79 | Resistor, 680 ohms, ½ watt | 19309-45BF |
| R72 | Resistor, 7500 ohms, 20 watt | 19397-41 |
| R73 | Resistor, 10K, 20 watt | 19397-43 |
| R74 | Resistor, 100 ohms, ½ watt | 19309-167 |
| R78,R98 | Resistor, 470K, ½ watt | 19309-113BF |
| R84 | Resistor, Variable, 500K | 15342-11 |
| R85 | Resistor, 2500 ohms, 10 watt | 19396-1 |
| R86,R89,R95 | Resistor, 82K, ½ watt | 19309-287BF |
| R87,R88 | Resistor, 120K, ½ watt | 19309-181BF |
| R93 | Resistor, Variable, 50K includes switch S10 | 15342-21 |
| R99 | Resistor, 360 ohms, 1 watt | 19310-211BF |
| R101 | Resistor, Variable, 25K | 15342-4 |
| R102 | Resistor, 820 ohms, ½ watt | 19309-266 |
| R111 | Resistor, 47K, ½ watt | 19309-284BF |
| R112 | Resistor, 390 ohms, ½ watt | 19309-162BF |

| Symbol Designations | Description | Hammarlund Part No. |
|---|---|---|
| R113 | Resistor, 330K, ½ watt | 19309-241BF |
| R114 | Resistor, 470 ohms, ½ watt | 19309-169BF |
| S1A,B,C,D | Switch base and spring assembly | 31234-G1 |
| S2 | Crystal Selector Switch, rotary | 15879-2 |
| S3 | Crystal switch, rotary | 31469-1 |
| S4 | Switch, conversion | 15862-2 |
| S5A,B,C | Selectivity Switch, Rotary | 15856-1 |
| S6,S7,S9 | Toggle Switch SPST | 15864-1 |
| S8 | Toggle Switch, DPDT | 15867-1 |
| S10 | Switch "ON-OFF" part of R93 | - |
| S11 | Switch, DPDT, Spring return | 15880-1 |
| S12 | Switch, BFO-AVC, Rotary | 31469-3 |
| S13 | Switch, IFO, Rotary | 31469-2 |
| T1 | IF Transformer, mixer plate, 455KC and 3,955 kc (with shield can) includes C67,C69,C70,L31,L32,R31 | 31183-G1 |
| T2 | IF Transformer, 3,955 kc (with shield can) includes C97,C98,C99,L33,L34,R35 | 31116-G2 |
| T3 | IF Transformer, Crystal filter (with shield can) includes C107,C110,C111, C112,C113,C114,L36,L37,R41,& Y8 | 31114-G2 |
| T4 | IF Transformer, 455KC (with shield can) includes C117,C118,C119,C120,L38,L39, L40,R49 | 31102-G2 |
| T5 | IF Transformer, 455KC, (with shield can) includes C123,C124,C125,C126,L41,L42,L43, R54 | 31102-G2 |
| T6 | Oscillator Subassembly, BFO (with shield) can) includes C130,C131,C132,C133,C134, L44,L45,L46,R76,R77 | 31106-G1 |
| T7 | AF Transformer, audio output | 31086-2 |
| T8 | Power Transformer | 31029-2 |
| T9 | Oscillator Subassembly, 3.5mc, includes C103,C104,C167,C168,C169,C170,C171,C172 C173,L22,R38,R40,R118,Y7 | 31131-G2 |
| T34 | Oscillator Subassembly, Frequency control unit, includes V3,P8,R23,R24,R25,R34,R71, R120,C45,C60,C61,C62,C63,C64,C65,C101,E11, E12,E19,L21,L23,L35,T35,S2,J8,X21,X22,X23 X24,X25,X26,X3 | 31409-2 |
| T35 | RF Transformer, autotransformer, 2 taps | 33922-G1 |
| X1-X3,X6-X15 X18-X20 | Tube socket, miniature | 15984-4 |
| X4 | Tube socket, miniature ceramic, less center shield | 15989-5 |
| X5 | Tube socket, miniature ceramic, with center shield | 15989-3 |
| X16 | Tube socket, noval | 16100-1 |
| X17,X19 | Tube socket, octal | 16082-1 |
| X21-X26 | Crystal socket, ceramic for crystals Y1 to Y6 | 16092-5 |
| Y1-Y6 | Crystal Unit Cr-18/U, see note below | 31473-spec |
| Y7 | Crystal, 3.5 mc | 31130-1 |

| Symbol Designations | Description | Hammarlund Part No. |
|---|---|---|
| Y8 | Crystal, 455 kc | 31471-1 |
| Miscellaneous | Button, plug | 29619-2 |
| | Chart, plastic, front panel | 31463-1 |
| | Core, adjustable tuning (red lacquer end) | 31013-1 |
| | Coupling, Flexible, stiff | 415-G2 |
| | Coupling, Flexible, soft | 415-G3 |
| | Cover, fuse, spare | 31494-1 |
| | Coupling, rigid | 31275-G1 |
| | Dial Lamp Socket Assembly | 31453-1 |
| | Dial, band indicator | 31201-G1 |
| | Dial, Main | 31438-1 |
| | Dial, Vernier | 31439-1 |
| | Dial, with knob (RF Gain) | 31227-G1 |
| | Dial, with knob (Audio Gain) | 31227-G2 |
| | Dial, with knob (Crystal Phasing) | 31227-G3 |
| | Dial, with knob (Beat Frequency Osc.) | 31227-G4 |
| | Dial, with knob (Selectivity) | 31227-G5 |
| | Glass, Main or Vernier dial | 31281-1 |
| | Glass, band indicator | 31282-1 |
| | Holder, fuse | 15923-1 |
| | Knob (Tuning lock) | 31462-G1 |
| | Knob, black ($\Delta$ Freq) | 31434-G1 |
| | Knob, red (IFO, BFO-AVC, XTALS) | 31434-G2 |
| | Knob (Tuning, Band Change) | 31215-G1 |
| | Packing, for top cover | 31477-1 |
| | Retainer, tube, includes small top hat | 16141-2 |
| | Retainer, tube includes large top hat | 16140-2 |
| | Screw, captive, spare fuse cover | 31495-1 |
| | Shell, hood for J6 | 16641-1 |
| | Spring, anti-backlash, spider | 31239-1 |
| | Spring, Band Change Detent | 31205-1 |
| | Spring, Conversion Switch | 31125-1 |
| | Spring, Crystal Retaining | 31417-1 |
| | Spring, IF adjuster grounding | 31023-1 |
| | Spring, Indicator Slide | 31126-1 |
| | Spring, Retainer for RF Coils | 31004-1 |
| | Spring, Retainer for RF Tuners | 31003-1 |
| | Spring, turret rotor end play | 31278-1 |
| | Wrench, Set Screw No. 6 | 11806-2 |
| | Wrench, Set Screw No. 8 | 11806-3 |
| | Wrench, Set Screw No. 10 | 11806-4 |

NOTE: Crystals supplied on special order, per Hammarlund Specification No. 31473, for use in the Crystal Frequency Control Unit, see page 8, shall be made in accordance with Signal Corps Specification CR-18/U. The frequency tolerance shall be within plus or minus .005%. The holder shall be in accordance with HC-6/U or CR-7.

The Signal Frequency for which the crystal is to be used shall be stamped on the top of the holder.

The oscillator or actual crystal frequency for a given signal frequency shall be determined from the following:

| Signal Frequency MC | Add IF Frequency MC | Mode of Operation |
|---|---|---|
| 00.75000 to 07.39999 | 0.455000 | Fundamental |
| 07.40000 on 3.45 to 7.40 band | 0.455000 (see note below) | Fundamental |
| 07.40000 on 7.40 to 14.8 band | 3.955000 (see note below) | Fundamental |
| 07.40001 to 12.04499 | 3.955000 | Fundamental |
| 12.0450 to 44.04499 | 3.955000 and divide sum by 3 | 3rd Harmonic |
| 44.0450 to 54.00000 | 3.955000 and divide sum by 4 | 4th Harmonic |

NOTE: Since 7.40 mc is the signal frequency at which the intermediate frequency is changed for double conversion and since this signal frequency occurs at the high frequency end of the 3.45 to 7.40 mc band and also at the low frequency end of the 7.40 to 14.8 mc band, it is necessary to specify frequency band as well as Signal Frequency when ordering crystals for exactly 7.40 mc signal operation.